

MINES AND MINERAL DEPOSITS (EXCEPT FUELS) FERGUS COUNTY, MONT.

BY ALMON F. ROBERTSON

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INTRODUCTION

This report is one of a series based upon investigations made and being made within the Missouri River Basin in Montana by engineers of the Bureau of Mines, Albany Branch, Mining Division. These investigations are being made primarily to provide preliminary information to the Department of Interior agencies and to others concerned with planning the proposed Federal power developments within the Missouri River Basin. This report has been designed to permit public distribution of the factual data obtained.

Virtually all known metallic-mineral occurrences and some nonmetallic mineral deposits within Fergus County were investigated in 1948. The investigations cannot be considered complete, however, because some long inactive mines or prospects may have been missed. Most of the old mine and prospect openings now are caved; many are completely inaccessible. Many of the claims located years ago have been abandoned; others have been relocated under different names and ownerships. Because of such conditions, much of the information regarding their development and operation necessarily has been obtained from available Federal and State publications, supplemented by information provided by owners and local residents.

ACKNOWLEDGMENTS

Information concerning their respective company activities, as related to the mineral industry within the county, was provided by the Anaconda Copper Mining Co., the American Smelting & Refining Co., the Montana Power Co., the Chicago, Milwaukee, St. Paul, & Pacific Railroad, and the Great Northern Railroad.

Detailed statistical information was supplied by the U. S. Weather Bureau at Helena, Mont., and by the Economic and Statistical Division, Bureau of Mines, at Salt Lake City, Utah, and Washington, D. C.

Special acknowledgment is made to the many mine and claim owners for their kind cooperation in providing information and for assistance given in the field.

Much valuable information was obtained from reports and publications by the Montana Bureau of Mines and Geology, the U. S. Geological Survey, the U. S. Bureau of Mines, the State of Montana, and other sources. The sources of such information are numbered in parentheses in the text. These numbers refer to correspondingly numbered items in the list of references at the end of this report.

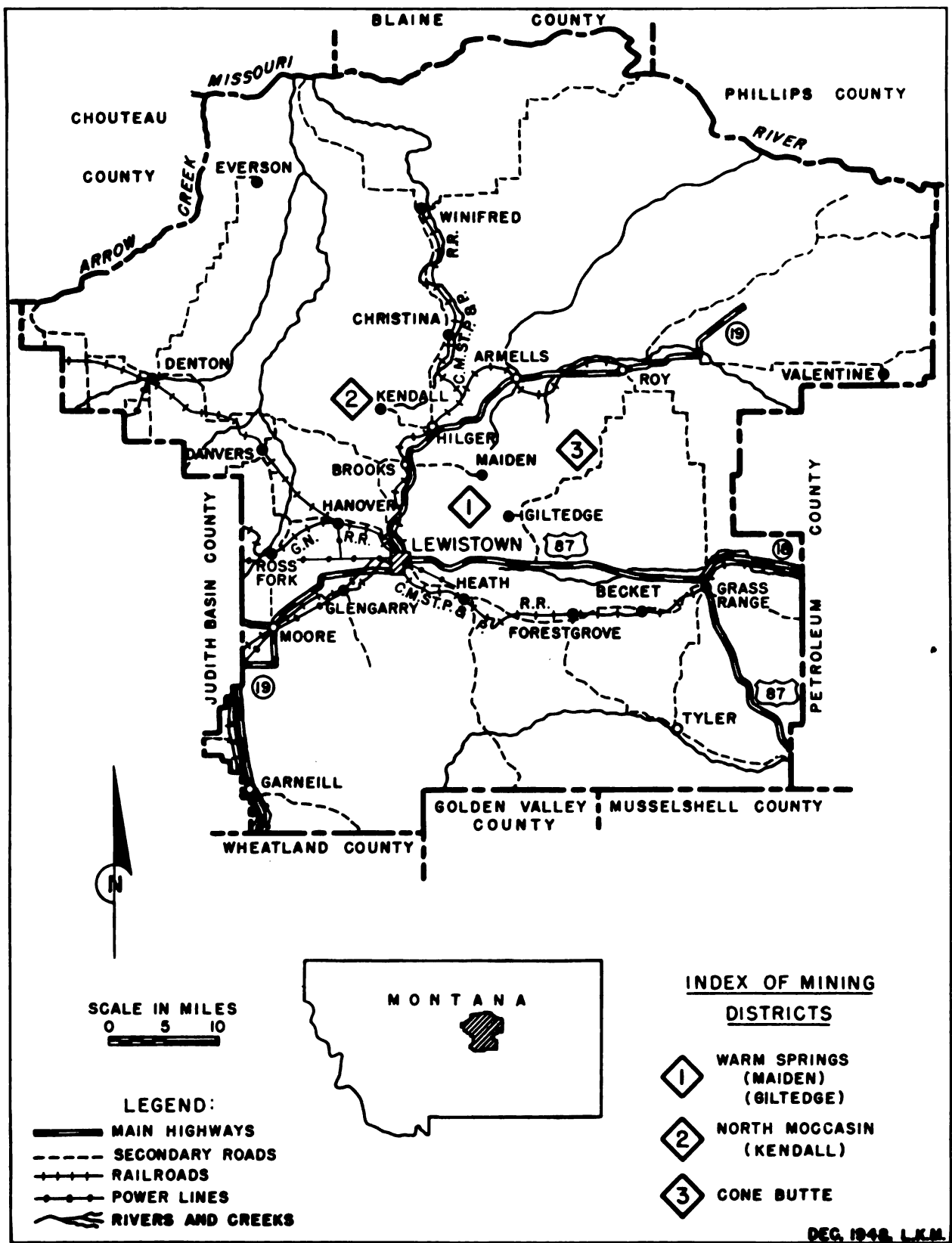


Figure 1. - Index map, Fergus County, Mont.

LOCATION AND ACCESSIBILITY

Fergus County is in central Montana; it embraces an area of 4,322 square miles. Population, according to the 1940 census, was 14,040. Lewistown, the county seat, had a population of 5,874; it is in the south-central part of the county and is the principal town and supply center. Mining activity has centered around three principal districts (fig. 1).

U. S. Highway 87 and State Highway 19 cross the county. County and side roads lead from these highways and provide access to the various mines. The branch line of the Chicago, Milwaukee, St. Paul, & Pacific Railroad from Harlowton to Great Falls and Winnett passes through Lewistown. From Lewistown, one branch runs north to Roy Junction, whence two short branches lead, respectively, to Winifred and Roy. The branch line of the Great Northern Railroad from Great Falls terminates at Lewistown.

The principal mining areas are within about 25 miles north of Lewistown. Distances, in miles by railroad, between Lewistown and the smelting plants in Montana via the above-mentioned railroads are as follows:

Shipping point	American Smelting & Refining Co., East Helena		Anaconda Copper Mining Co., Washoe sampler, Butte		Anaconda Copper Mining Co. zinc plant, Great Falls	
	G.N.R.R.	C.M.St.P.&P.	G.N.R.R.	C.M.St.P.&P.	G.N.R.R.	C.M.St.P.&P.
Lewistown	1/221	2/208	288	251	118	136

1/ Includes 5 miles from Helena to East Helena via Northern Pacific Railroad.

2/ Includes 49 miles from Lombard to East Helena via Northern Pacific Railroad.

CLIMATE

The climate generally is semiarid but varies considerably according to the location and altitude. Summer temperatures are moderate, with warm days and cool nights; maximum temperature seldom exceeds 100°. Winters are long and severe. Then, rapid changes in temperatures may be expected; often, during a single day the temperatures may range from above freezing to more than 40° below zero.

Total annual snowfall in the valleys and on the plains ranges from 3 to 5 feet in depth, but in the mountains it may be considerably deeper. At Crystal Lake (altitude 6,200 feet) the accumulated snow pack during March 1941 to 1948, as measured and reported by the U. S. Forest Service, ranged from 28 to 50 inches.

Indicated climatological data compiled from statistics provided by the U. S. Weather Bureau, Helena, Mont., as recorded at selected stations in Fergus County, are given in tables 1, 2, and 3.

TABLE 1. - Average monthly and annual precipitation^{1/}, inches, at certain
U. S. Weather Bureau Stations in Fergus County, Mont.

Station.....	Denton	Lewistown airport	Winifred	Grass Range	Roy
Altitude, feet.....	3,818	4,138	3,250	3,488	3,445
Length of record, years...	24	49	32	16	14
January.....	0.58	0.74	0.54	0.33	0.36
February.....	.34	.74	.44	.39	.36
March.....	.56	1.04	.58	.94	.58
April.....	.79	1.27	.81	1.02	.80
May.....	2.00	2.94	2.12	2.26	1.80
June.....	3.20	3.64	2.42	4.13	3.05
July.....	1.90	2.26	1.49	1.50	1.75
August.....	1.10	1.43	0.81	1.05	1.16
September.....	1.38	1.63	1.09	1.16	0.97
October.....	0.66	1.24	1.04	1.08	.82
November.....	.44	0.63	0.57	0.44	.42
December.....	.50	.84	.61	.26	.39
Annual average.....	13.45	18.40	12.52	14.56	12.46

^{1/} Includes snowfall converted to water.

TABLE 2. - Average monthly and annual snowfall, inches, at certain
U. S. Weather Bureau Stations in Fergus County, Mont.

Station.....	Denton	Lewistown	Winifred
Altitude, feet.....	3,818	4,138	3,250
Length of record, years.....	17	30	8
January.....	11.6	11.1	5.9
February.....	6.8	10.5	5.3
March.....	8.4	9.8	5.1
April.....	5.9	6.1	4.9
May.....	1.8	2.5	0.2
June.....	0.0	Trace	.0
July.....	.0	0.0	.0
August.....	Trace	Trace	.0
September.....	2.0	1.9	Trace
October.....	4.2	5.4	1.0
November.....	5.7	9.7	9.9
December.....	8.7	11.9	9.6
Annual average.....	55.1	68.9	41.9

TABLE 3. - Average temperature data, degrees Fahrenheit, at certain
U. S. Weather Bureau Stations in Fergus County, Mont.

Station.....	Denton	Lewistown	Winifred...
Length of record, years.....	17	32	9
Annual average.....	43.8	42.6	43.6
Mean maximum:			
January.....	31.0	32.6	28.1
July.....	81.0	81.7	87.4
Annual.....	55.5	56.5	57.9
Mean minimum:			
January.....	9.1	9.6	5.3
July.....	53.1	48.6	52.3
Annual.....	32.0	28.6	29.4
Highest:			
January.....	63.0	60.0	64.0
July.....	106.0	105.0	106.0
Annual.....	106.0	105.0	106.0
Lowest:			
January.....	-46.0	-46.0	-40.0
July.....	37.0	32.0	39.0
Annual.....	-46.0	-46.0	-40.0
Latest date 32° or lower in spring..	May 3 to June 3	May 13 to July 4	May 13 to June 7
Earliest date 32° or lower in fall..	Aug. 24 to Oct. 23	Aug. 9 to Sept. 29	Sept. 1 to Oct. 7

TOPOGRAPHY

The topography of Fergus County is varied. Rolling plains form the northern part of the county. In the central part, the North Moccasin, South Moccasin, and Judith Mountains rise abruptly from the surrounding, gently sloping benches. The Snowy Mountains extend east and west along the southern border.

Altitudes range from about 2,100 feet above sea level in the extreme northeastern part of the county to a maximum of 8,600 feet at Big Snowy Peak on the southern boundary. The average altitude is between 3,000 and 4,000 feet.

The South Moccasin Mountains are the smallest of the mountain ranges; they embrace an area of about 30 square miles. The peaks and ridges are rounded. Slopes are gradual, except on the north side, where erosion has cut steep-walled canyons into the up-ended sedimentary rocks. The highest peak has an altitude of 5,200 feet, or about 1,600 feet higher than the surrounding plain.

The North Moccasin Mountains, a few miles north of the South Moccasin Mountains, are about the same in area but are longer in a north-south direction. They are of medium relief. Triangulation Peak, in the northeast, attains on altitude of about 5,700 feet, or about 1,900 feet higher than the plain level.

The Judith Mountains, the largest of the three isolated ranges, are about 10 miles east of the South Moccasin Mountains. They rise steeply above the benches along the north side of the valley drained by Big Spring Creek. From about 4 miles northeast of Lewistown, these mountains extend northeasterly for nearly 20 miles. Judith Peak, with an altitude of 6,428 feet, is the highest point in this range. The higher peaks and ridges are rounded and have gentle slopes. Erosion has cut deep gorges into the sedimentary rocks bordering the mountains.

Most of the streams within the county flow intermittently, except those fed by large springs, such as Big Spring Creek and Warm Spring Creek. In the mountain areas, spring-fed rivulets carry water for short distances before disappearing into sediments and surface debris. All of the streams north of the Snowy Mountains ultimately flow into the Missouri River, which conforms with the northern boundary of the county. A few intermittent streams on the east end of the Snowy Mountains and on the east side of the Judith Mountains flow into the Musselshell River, a tributary of the Missouri River.

The north slopes of the mountains generally are covered with a dense growth of timber suitable for mining purposes; the south slopes are sparsely timbered or are covered with grass.

The broad valleys and wide benches surrounding the mountains are very fertile. Farming and stock raising are the principal industries.

HISTORY

Placer gold was discovered in Alpine Gulch near Maiden in the Judith Mountains in 1880. The first lode-mining claim, the War Eagle, was located in 1881. Within a few years, many mines throughout the Judith Mountains were in operation. The first stamp mill was built in 1882 or 1883 at the Collar mine, about 2 miles northeast of Maiden (27). Several mines in the vicinity of Maiden were operated extensively up to 1916. Since then, these mines have been worked only intermittently on a small scale.

The gold deposits near Gilt Edge were discovered in 1884; however, their development was delayed until 1893, or after the cyanide process for the extraction of gold and silver was introduced (34). The mines in the Gilt Edge area operated intermittently until about 1916, when virtually all operation ceased.

The gold-bearing ore bodies near Kendall, in the North Moccasin Mountains, were not discovered until 1893. Little work was done in this area until after 1900, when two cyanide mills were constructed (33). Mining and milling near Kendall were more or less continuous until 1923.

Several properties at the northeast end of the Judith Mountains, near Cone Butte, were worked intermittently between 1880 and 1900. Since then, a few properties have been operated at different times on a small scale by lessees.

Operations at all of the mines were carried on under difficulties in the past. Only high-grade ore could be mined profitably because of exceedingly high costs for transportation and equipment. Before 1883, supplies and equipment were obtained via Fort Benton, about 60 miles distant; they were delivered there by small steamboats, which traveled up the Missouri River. After 1883, when the Northern Pacific Railroad was built across Montana, supplies had to be obtained at Billings, about 125 miles southeast.

A small lead smelter was erected near Maiden in 1886 to smelt the lead-silver ores mined in that area (27). It was operated for a short time only and dismantled.

As the mines became deeper, pumping problems were encountered. The character of the ores also changed. Milling methods that previously had been used successfully were not adapted to those ores. At Gilt Edge and at the Kendall it became necessary to roast some gold ore, known as "black ore," before it could be cyanided. Higher costs and the exhaustion of the higher-grade ores caused most of the mines to suspend operation. The increase in the price of gold in 1933 caused a revival of interest in the gold mines, and some mining was undertaken; this was discontinued in 1943, when all gold mining was stopped by government order L-208. Since 1943 very little mining has been done in the county; only a few tons of lead, zinc, or copper ores have been shipped.

PRODUCTION

Table 4 shows the production of gold, silver, copper, lead, and zinc in Fergus County from 1886 to 1947, inclusive, in terms of recovered metals. The table is a tabulation of data furnished by the Economics and Statistics Division, Bureau of Mines, Salt Lake City, Utah.

Production data for certain years are not available. Therefore, the total production for Fergus County apparently was greater for the period 1886-1947 than the totals shown in table 4.

No metals except those recorded in table 4 are reported to have been produced in Fergus County.

Two companies have been mining and processing gypsum in Fergus County for many years. Plants are operated at Heath and Hanover. Limestone was mined and used in the production of Portland cement at a plant at Hanover between 1917 and 1931. No production statistics on nonmetallic minerals are available for publication.

GEOLOGY, GENERAL

The North Moccasin Mountains, the South Moccasin Mountains, and the Judith Mountains are domal structures formed by laccolithic intrusions. Sedimentary rocks ranging in age from Cambrian to Cretaceous were intruded by igneous rocks in the late Cretaceous or early Tertiary period (1) (34). Igneous intrusions caused deformation and arching of the sedimentary series, which now dip away from the central igneous cores in all directions. Later erosion removed some of the uplifted, arched, sedimentary beds, exposing the igneous rocks.

TABLE 4. - Mine production of gold, silver, copper, lead, and zinc in Fergus County, Mont., for years 1886-1947 in terms of recoverable metals

Year	Producing mines		Ore sold or treated (short tons)	Gold-Fine ounces			Silver-Fine ounces			Copper		Lead		Zinc		Total value
	Lode	Placer		Lode	Placer	Value Lode & placer	Lode	Placer	Value Lode & placer	Pounds	Value	Pounds	Value	Pounds	Value	
1886	1/	1/	1/	2/	2/	\$76,176	1/	1/	1/	---	---	---	---	---	---	\$76,176
1887	do	do	do	do	do	85,330	do	do	do	---	---	---	---	---	---	85,330
1888	do	do	do	do	do	140,506	do	do	do	---	---	---	---	---	---	140,506
1889	do	do	do	do	do	63,326	2/	2/	4,285	---	---	---	---	---	---	67,611
1890	do	do	do	do	do	141,285	1/	1/	1/	---	---	---	---	---	---	141,285
1891	do	do	do	do	do	73,021	2/	2/	25,437	---	---	---	---	---	---	98,458
1892	do	do	do	do	do	1,340	do	do	405	---	---	---	---	---	---	1,745
1893	do	do	do	do	do	28,639	do	do	172	---	---	---	---	---	---	28,811
1894	do	do	do	do	do	77,951	do	do	221	---	---	---	---	---	---	78,172
1895	do	do	do	do	do	11,340	do	do	54	---	---	---	---	---	---	11,394
1896	do	do	do	do	do	47,032	do	do	54	---	---	---	---	---	---	47,086
1897	do	do	do	do	do	65,086	do	do	142	---	---	---	---	---	---	65,228
1898	do	do	do	do	do	128,199	do	do	168	---	---	---	---	---	---	128,367
1899	do	do	do	1/	1/	1/	1/	1/	1/	---	---	---	---	---	---	1/
1900	do	do	do	do	do	do	do	do	do	---	---	---	---	---	---	do
1901	3	---	59,865	19,387.00	---	403,909	---	---	---	---	---	---	---	---	---	403,909
1902	8	---	145,218	34,323.00	---	686,476	1,548	---	769	---	---	---	---	---	---	687,245
1903	5	---	176,621	54,642.89	---	1,051,184	647	---	324	---	---	---	---	---	---	1,051,508
1904	5	---	224,342	61,168.50	---	1,264,463	1,519	---	839	---	---	---	---	---	---	1,265,302
1905	5	---	224,273	60,719.80	---	1,255,190	3,369	---	2,035	---	---	10,000	470	---	---	1,257,695
1906	6	---	228,434	49,577.89	---	1,024,866	2,997	---	2,008	641	100,914	5,752	---	---	---	1,033,267
1907	6	2	162,717	31,244.99	71.49	647,369	3,441	189	2,396	1,219	244	52,519	2,783	---	---	652,792
1908	8	---	197,697	36,818.02	---	761,096	10,773	---	5,710	---	---	---	---	---	---	766,806
1909	8	---	196,951	35,121.89	---	726,034	5,491	---	2,855	204	26	11,210	482	---	---	729,397
1910	8	---	145,747	30,802.88	---	636,752	9,283	---	5,013	1,167	148	60,254	2,651	18,000	972	645,536
1911	6	1	98,546	17,343.17	3.19	358,581	8,675	1	4,598	---	---	17,446	785	75,995	4,332	368,296
1912	9	1	68,726	21,334.39	2.95	441,082	11,058	---	6,801	274	45	11,863	534	15,301	1,056	449,518
1913	13	---	55,310	22,238.62	---	459,713	9,939	---	6,003	1,073	166	17,457	768	49,999	2,800	469,450
1914	7	---	52,825	25,307.28	---	523,148	5,716	---	3,161	---	---	---	---	---	---	526,309
1915	7	---	49,524	22,871.99	---	472,806	4,311	---	2,186	1,297	227	18,713	880	---	---	476,099
1916	12	---	66,235	20,931.23	---	432,687	13,920	---	9,159	8,280	2,037	93,351	6,441	---	---	450,324
1917	9	---	38,144	13,004.89	---	268,835	2,979	---	2,455	245	67	4,595	395	---	---	271,752
1918	11	---	37,470	10,179.36	---	210,426	5,725	---	5,725	402	99	5,333	379	---	---	216,629
1919	5	---	42,168	10,134.27	---	209,494	2,812	---	3,149	1,288	240	---	---	---	---	212,883
1920	6	---	15,957	6,394.55	---	132,187	4,739	---	5,166	1,008	185	358	29	---	---	137,567
1921	3	1	15,118	3,906.82	10.64	80,981	1,757	1	1,758	---	---	---	---	---	---	82,739
1922	9	1	5,075	1,443.07	1.89	29,870	2,957	---	2,957	---	---	---	---	---	---	32,827
1923	3	1	121	125.77	7.50	2,755	1,231	1	1,010	---	---	---	---	---	---	3,765
1924	8	---	104	65.69	---	1,358	1,227	---	822	---	---	1,192	95	---	---	2,275
1925	8	2	203	435.95	20.52	9,436	2,466	---	1,711	---	---	---	---	---	---	11,147
1926	3	---	126	160.02	---	3,308	2,356	---	1,470	---	---	---	---	---	---	4,778
1927	3	---	60	98.68	---	2,040	2,053	---	1,164	---	---	---	---	---	---	3,204
1928	3	---	65	95.44	---	1,973	1,701	---	995	---	---	---	---	---	---	2,968
1929	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1930	1	1	1	4.55	9.38	288	20	---	8	---	---	---	---	---	---	296
1931	3	---	875	611.02	---	12,631	813	---	236	225	20	---	---	---	---	12,887
1932	4	---	1,470	378.00	19.40	8,215	440	---	124	206	13	---	---	---	---	8,352
1933	4	4	700	213.33	18.77	4,798	143	---	50	31	2	---	---	---	---	4,850
1934	10	3	599	266.58	21.66	10,074	3,380	3	2,187	150	12	1,378	51	---	---	12,324
1935	15	6	1,609	231.60	54.77	10,323	14,510	11	10,437	241	20	1,250	50	---	---	20,830
1936	14	5	4,953	711.40	22.60	25,690	5,277	9	4,094	3,663	337	239	11	---	---	30,132
1937	14	4	16,913	1,927.00	12.00	67,865	7,170	---	5,546	1,000	121	3,000	177	---	---	73,709
1938	6	2	30,128	2,763.00	6.00	96,915	3,779	---	2,443	204	20	3,000	138	---	---	99,516
1939	8	3	51,695	3,168.00	17.00	111,475	3,465	---	2,352	38	4	383	18	---	---	113,849
1940	8	4	65,788	2,611.00	10.00	91,735	1,859	---	1,322	---	---	1,900	95	---	---	93,152
1941	6	1	75,661	2,732.00	28.00	96,600	1,246	45	918	150	18	---	---	---	---	97,536
1942	2	2	54,815	1,749.00	5.00	61,390	744	---	529	---	---	---	---	---	---	61,919
1943	2	1	3,004	114.00	7.00	4,235	90	---	64	---	---	200	15	---	---	4,314
1944	1	1	47	---	6.00	---	---	---	---	5,400	729	---	---	---	---	939
1945	---	1	---	---	2.00	70	---	---	---	---	---	---	---	---	---	70
1946	1	1	50	19.00	9.00	980	36	---	29	3,000	486	---	---	---	---	1,495
1947	---	1	---	---	4.00	140	---	---	---	---	---	---	---	---	---	140
1948	3/	---	2,615,950	607,377.53	370.76	\$13,640,884	167,662	260	\$143,516	34,083	\$5,907	416,555	\$22,999	159,295	\$9,160	\$13,822,466

1/ Not available
 2/ Segregation of lode and placer gold not available
 3/ Exclusive of 1/ and 1929

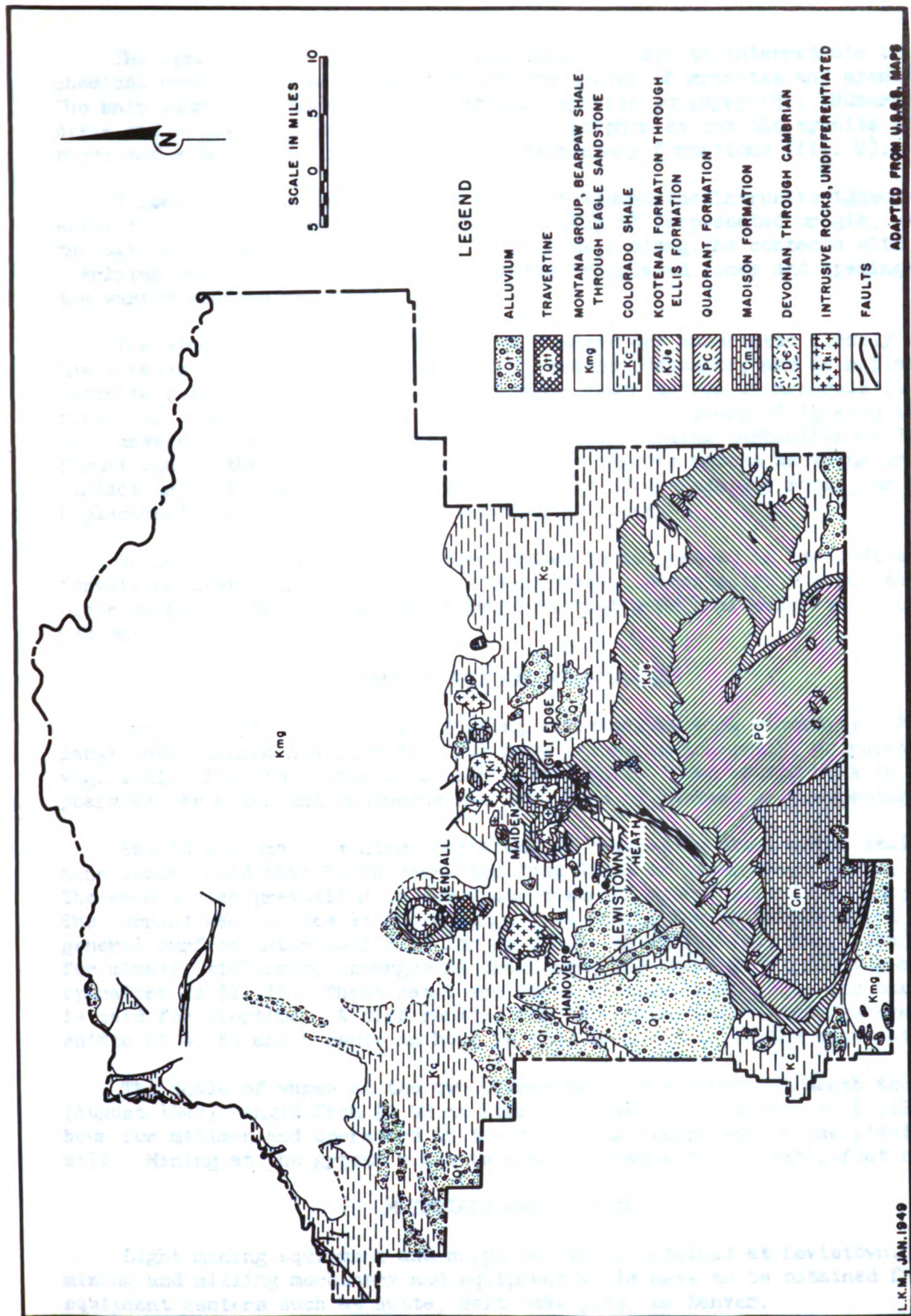


Figure 2. - Generalized geologic map of Fergus County, Mont.

The igneous intrusives are predominantly acidic to intermediate in chemical composition and range through the groups of granites and syenites. The main intrusive masses are essentially syenite porphyry (5). Numerous dikes and sills of phonolite and tinguaitite porphyries cut the syenite porphyry and extend into the surrounding sedimentary formations (fig. 2).

A long period of hydrothermal action followed the intrusive igneous activity. Mineral-bearing solutions, probably of deep-seated origin, ascended through cracks and fissures in the igneous mass along the contacts with the overlying sedimentary rocks and penetrated brecciated zones and openings in the warped sedimentary beds.

The mineral deposits in the mountain areas are associated closely with the igneous rocks. They occur as veins, contact deposits, and as replacement deposits (1) (5) (34). No pronounced zonal distribution of minerals is noticeable. Some mineral deposits occur along the periphery of igneous intrusive masses at or near the contact with the surrounding Carboniferous limestone formations. Other deposits occur within the igneous masses as veins or as contact deposits under the overlying remnants of sedimentary rocks, or as replacements in both igneous and sedimentary rocks.

No metallic mineral deposits are known to be present in the sedimentary formations distant from the igneous intrusives. Nonmetallic mineral deposits occur mainly in the sedimentary formations that were unaffected by igneous action (9).

LABOR SUPPLY AND WAGE SCALES

Fergus County is largely a farming and stock-raising community. No large-scale mining has been done for many years; consequently, no recognized wage scales for mine labor have been established. Most of the work in recent years at the mines and prospects has been done by lessees or prospectors.

Should systematic mining operations be resumed in the county, skilled mine labor would have to be recruited from Butte or other large mining centers. The wage scales prevailing in the Butte district probably would be adopted. The current wage scales at Butte range from \$10.61 for an 8-hour shift for general surface labor to \$12.36 for an 8-hour shift for hoistmen. The rate for miners, timbermen, underground shovelers, and underground mucking-machine operators is \$11.11. These rates are for a 40-hour week. Time and one-half is paid for overtime. A differential for afternoon, night, and graveyard shifts of 4, 6, and 8 cents an hour is paid in addition to the base rates.

The scale of wages at the two operating gypsum plants at Heath and Hanover (August 1948) ranged from \$0.92 an hour for unskilled laborers to \$1.125 an hour for millmen and operators in the calcining plants and in the plasterboard mill. Mining at the gypsum mines is done by contract on a cubic-foot basis.

MATERIALS AND SUPPLIES

Light mining equipment and supplies can be obtained at Lewistown. Heavy mining and milling machinery and equipment would have to be obtained from equipment centers such as Butte, Salt Lake City, or Denver.

Plenty of mine timber is available in or near most of the mine areas. Owing to increased labor costs, the cost of rough sawed timber suitable for most mine purposes has increased considerably. Mine timbers that formerly sold at \$20 to \$25 a thousand board feet now cost \$0.035 to \$0.10 a lineal foot, depending on the size of the timber and the length of haul. Stumpage for saw timber cut on National Forest land is now \$3.50 a thousand board feet, compared with the former cost of \$1.

Gasoline, Diesel oil, and lubricating oils are obtainable at Lewistown or at most of the small communities along the railroads where storage tanks are available. Several of the oil companies will deliver those products within a radius of about 25 miles from the storage facilities. Delivered prices for Diesel oil at Lewistown during August 1948 were from 15 to 16 cents a gallon.

Explosives suitable for mining purposes are available at Lewistown. Prices probably would be comparable with those at Butte. Current Butte prices (1948) for mining explosives ranged from \$14.75 to \$23.75 a 100 pounds, depending on the type, strength, and quantity.

POWER

The central part of Fergus County is traversed by a 44,000-volt power transmission line of the Montana Power Co., which extends from Great Falls to Lewistown, thence southwesterly to Moore, Garneill, and Harlowton. Branch lines carrying a lower voltage extend from the main transmission line to Hanover and Heath.

During the summer of 1948 a new 110,000-volt line was built by the Montana Power Co. from Great Falls to Harlowton. This line now has been connected through transformers to the old line to Lewistown, whose voltage has been increased to 50,000. The load capacity on the line to Hanover is 2,700 kilowatts; on the main line to Lewistown, about 3,000 kilowatts; and about 900 kilowatts on the Heath extension.

A power plant that produced about 500 kilowatts was operated for several years on Warm Spring Creek. This power was used at the mines near Kendall for a number of years. This plant has been idle since 1925; it later was sold to the Montana Power Co. but was not operated. With this exception, no electric power has been available for use at any of the metal mines in the county.

The Montana Power Co. rates (Schedule GS-44) are based on a sliding scale for actual kilowatt-hour consumption plus a charge based on peak kilowatt demand.

Montana Power Co. power rates (Schedule GS-44)

Rate (net monthly bill):

\$0.75 for the first 12-kw-hr. or less.
.035 per kw-hr. for the next 288 kw-hr.
.025 per kw-hr. for the next 1,500 kw-hr.
.015 per kw-hr. for the next 3,200 kw-hr.
.009 per kw-hr. for the next 15,000 kw-hr.
.007 per kw-hr. for the next 200 kw-hr. per kw. of demand.
.005 per kw-hr. for all additional kw-hr.

Plus demand charge:

First 10 kw.	No charge.
Next 20 kw.	\$0.95 per kw. of demand.
All additional kw.	.75 per kw. of demand.

TRUCKING RATES

Condition of roads, road grades, loading and unloading facilities, as well as length of haul influence trucking rates from the mines to the railroads or smelters. None of the trucking or hauling contractors have established rates for hauling ore from the mines in Fergus County. Special arrangements must be made for each hauling job.

Some truckers will haul ore direct from the mines to the smelter at East Helena or to the Washoe sampler at Butte. Others will haul only from easily accessible points on the railroads or main highways. Mountain roads, which are passable to motor transportation during the summer, lead from the main highways to most of the formerly operated mines and prospects. During winter months, tractors or horse-drawn sleds are required. Contracted costs about 10 years ago for the hauling of 5-ton truck loads of ore from several prospects in the Judith Mountains to East Helena, a distance of about 210 miles, are reported to have ranged from \$0.12 to \$0.36 a ton-mile.

RAILROAD FREIGHT RATES

Railroad freight rates on ores and concentrates per ton, on minimum 30-ton carload lots, from railroad shipping points in Fergus and adjoining counties to smelter points in Montana, in effect October 1948, were as follows:

Chicago, Milwaukee, St. Paul, & Pacific Railroad

Value per ton, not exceeding..	\$15	\$25	\$35	\$50	\$100	Over \$100
To A.S. & R. smelter, East Helena, Mont., from:						
Royl/.....						
Brooks1/.....						
Lewistown.....	\$4.46	\$4.46	\$5.05	\$5.50	\$5.95	\$6.84
To Washoe sampler, A.C.M. Co., Butte, Mont., from:						
Roy.....	5.18	5.18	5.84	6.37	6.90	8.09
Brooks.....	4.61	4.61	4.20	5.80	5.10	7.14
Lewistown.....	4.46	4.46	5.05	5.50	5.95	6.84

1/ No established rates.

No freight rates have been established between the above or other railroad points along the Chicago, Milwaukee, St. Paul, & Pacific Railroad in Fergus County and the Anaconda Copper Mining Co. zinc plant at Great Falls, Mont.

Great Northern Railroad

Value, per ton, not exceeding.....	\$12	\$25	\$35	\$50	\$75	Over \$100
To A.S. & R. smelter, East Helena, Mont., from:						
Lewistown.....	\$3.34	\$3.72	\$4.31	\$4.76	\$5.05	\$5.65
Judith Gap, Wheatland County..	3.34	3.72	4.31	4.76	5.05	5.65
Hobson, Judith Basin County...	3.34	3.72	4.16	4.61	4.91	5.50
To Washoe sampler, A.C.M. Co., Butte, Mont., from:						
Lewistown.....	-	4.46	5.05	5.50	5.95	6.84
Judith Gap.....	4.00	4.46	4.91	5.35	5.65	6.24
Hobson.....	3.73	4.16	4.61	5.20	5.35	5.95
To A.C.M. Co. zinc plant, Great Falls, Mont., from:						
Lewistown.....	3.34	3.72	4.31	4.76	5.05	5.65
Judith Gap.....	2.81	3.12	3.58	4.01	4.16	4.76
Hobson.....	2.15	2.39	2.68	3.12	3.42	3.72

SMELTIER SCHEDULES

The following summarized schedules for ores and concentrates at smelters in Montana are indicative of schedules in effect October 1, 1948. They will be found useful for preliminary calculations only because applicable schedules usually are established only after representative samples submitted by the prospective shipper have been analyzed.

East Helena smelter, American Smelting & Refining Co., copper-lead-gold-silver ores and concentrates

Payments for metals:

Gold - minimum paid for, 0.03 ounce per ton.

Ounces per ton	Per ounce
0.03 to 3.0.....	\$31.81825
Plus 3.0.....	32.31825

Silver - pay for 95 percent at average of the Handy & Harman, New York quotations, or Mint price, less minimum deduction 1 Troy ounce per dry ton.

Lead - If 3 percent or over by wet assay, deduct from wet assay 1.5 units (a unit is 20 pounds) and pay for 90 percent of the remaining lead at the average of the daily published A. S. & R. Co. quotations for common desilverized domestic lead for delivery in New York City, less 1.8 cents per pound of lead accounted for.

Copper - If 1 percent or over, deduct from wet copper assay 1 unit and pay for 100 percent of the remaining copper at daily net refinery quotations for electrolytic cathodes as published in E. & M. J. Metal & Mineral Markets of New York, less a deduction of 6 cents per pound of copper accounted for.

Deductions:

Base charge - \$8 per net dry ton for treatment of ores and concentrates having a settlement lead content of 20 percent or less; deduct 10 cents per ton for each unit of lead over 20 percent, fractions in proportion; \$7 per ton for those having no payable lead content.

Arsenic and antimony (combined) - 2 percent free; excess charged at 50 cents per unit, fractions in proportion. 0.1 percent of lead content by wet assay allowed free; excess charged at 50 cents per pound.

Zinc - 10 percent free; excess charged at 30 cents per unit, fractions in proportion.

Sampling and assaying - Charge \$10 per lot when less than \$200 value and \$20 per lot when over \$200 value for shipments of less than 5 tons dry weight. Charge \$5 per lot when less than \$200 value and \$10 per lot when over \$200 value for shipments less than 10 tons dry weight.

Washoe sampler, Anaconda Copper Mining Co., Butte, Mont.,
copper, gold, and silver ores and concentrates

Payments for metals:

Copper - 96 percent of copper content, with minimum deduction of 10 pounds per ton, at E. & M. J. average price of electrolytic copper for week ending Wednesday preceding date of sampling, less 2.5 cents per pound.

Silver - 95 percent of silver content, with minimum deduction of 1 ounce per ton at Government price less 2 cents per ounce. Silver not eligible for Government price will be paid for at open market quotation, as quoted by E. & M. J.

Gold - 95 percent of gold content, with minimum deduction of 0.01 ounce per ton, at \$20 per ounce, plus 90 percent of premium in excess of \$20.67 per ounce. (This is equivalent to paying for 100 percent at \$31.81825 per ounce.)

Treatment charge, f.o.b. Washoe sampler, Butte, Mont.:

Base charge - \$4 per ton.

Add 10 percent of sum of metal payments in excess of \$15 per dry ton.

Add 12 cents for each 1 percent iron (Fe).

Deduct 2.5 cents for each 1 percent of silica (SiO_2) in excess of alumina (Al_2O_3).

Maximum total treatment charge to be \$5.50 per dry ton.

In case company elects to have shipments made direct to the smelter at Anaconda for sampling, the base treatment charge will be \$3.75 per dry ton, f.o.b. Anaconda Reduction Works, Anaconda, Mont., with maximum total treatment charge of \$5.25 per dry ton. Lots of less than 10 tons will be assessed an extra sampling charge of \$5 flat on each lot.

Electrolytic zinc plants, Anaconda Copper Mining Co.,
at Anaconda and Great Falls, Mont.
Zinc concentrates

The Anaconda Copper Mining Co. advises that it does not have any published or open schedules for the treatment of zinc concentrates at its Anaconda and Great Falls electrolytic zinc plants. Because of certain impurities, which complicate the treatment in these plants, only certain types and grades of zinc concentrates are now acceptable. The acceptability is decided after complete analysis of a representative sample of the zinc concentrates involved. If satisfactory, the terms of purchase then will be offered.

Terms of purchase of acceptable zinc concentrates by these zinc plants are indicated by the following, which pertains to some shipments of zinc concentrates made during 1948.

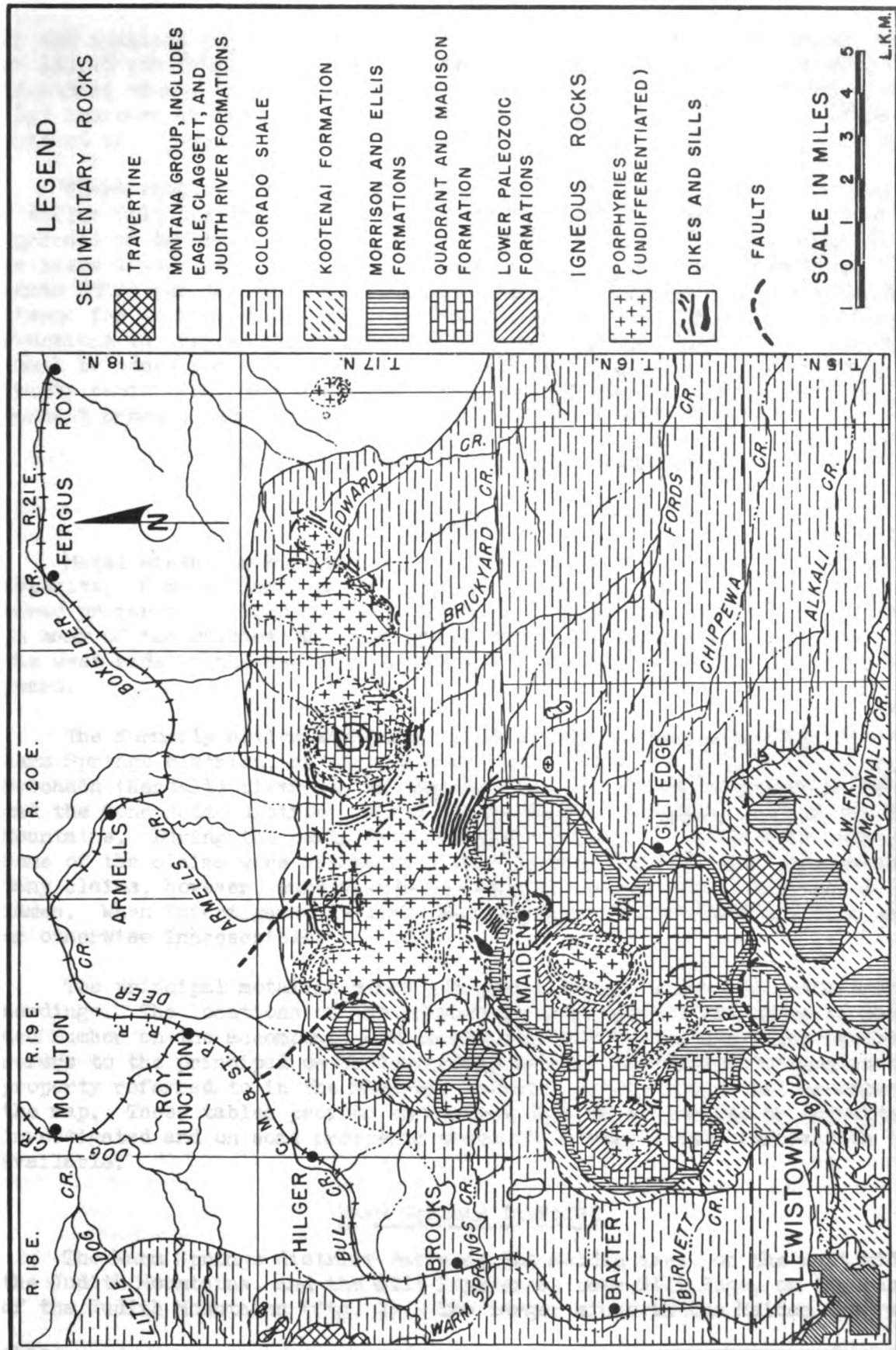
Payments for metals in zinc concentrates:

- Zinc..... Eighty percent (80%) of zinc content at St. Louis price for prime western zinc.
- Lead..... Eighty percent (80%) of lead content in excess of 3 percent, at New York price, less 2 cents per pound.
- Silver..... Eighty percent (80%) if 1.0 ounce per ton or over.
- Gold..... One hundred percent (100%) if 0.01 ounce per ton or over, at \$27.024 per ounce.
- Other metals.. No payment shall be made for any other metal or metals contained in concentrates, and such metals shall be the property of the Anaconda Co.

Prices for zinc and lead shall be those quoted by Engineering & Mining Journal for week of arrival of concentrates at plants of Anaconda Co.

Treatment charge:

Base treatment charge shall be thirty dollars (\$30) per dry ton of concentrates delivered and accepted, based on St. Louis price of prime western zinc of 10-1/2 cents (10-1/2¢) per pound; a cost of labor in the zinc plants



ADAPTED FROM U.S.G.S. AND MONTANA BUREAU OF MINES AND GEOLOGY MAPS.
Figure 3. - Geologic map of Judith Mountains, Fergus County, Mont.

of the Anaconda Copper Mining Co. at Anaconda and Great Falls, Mont., based at \$11.40 per 8-hour day with the addition to or subtraction from said base treatment charge per dry ton of concentrates of 1 cent (1¢) for each 1 cent (1¢) increase or decrease in said cost of 8-hour day employment; a lead content of 3 percent (3%); and arsenic plus antimony content of 0.125 percent.

There shall be added to or subtracted from said base treatment charge, 1 dollar (\$1) per dry ton of concentrates for each 1 cent (1¢) per pound increase or decrease in the price of prime western zinc at St. Louis above or below 10-1/2 cents (10-1/2¢) per pound, fractions proportionately. Fifty cents (50¢) per dry ton of concentrates shall be added to said treatment charge for each percent (1%) lead below 3 percent (3%) in such concentrates, fractions in proportion. Twenty-five cents (25¢) per dry ton of concentrates shall be added for each 1 percent (1%) of insoluble material plus iron. Twenty cents (20¢) per dry ton of concentrates shall be added for each 0.10 percent arsenic plus antimony in excess of 0.125 percent.

METALLIC MINES AND MINERAL OCCURRENCES

General

Metal mining in Fergus County has been confined mainly to gold and silver deposits. Copper, lead, and zinc ores have been mined at a few widely scattered properties. Gold placer deposits were discovered first; the deposits in many of the gulches in the North Moccasin Mountains and on the west side of the Judith Mountains were worked on a small scale for many years.

The formerly active mines are in three mining districts (fig. 1) - the Warm Springs district, at the southwest end of the Judith Mountains; the North Moccasin (Kendall) district, on the east side of the North Moccasin Mountains; and the Cone Butte district, which covers the northeastern part of the Judith Mountains. During the early days, hundreds of mining claims were located. Some of the claims were extensively developed and mined; some were patented. Many claims, however, were abandoned, some to be relocated later under other names. When investigated in 1948, most of the old mine workings were caved or otherwise inaccessible.

The principal metallic mines and prospects are described under district headings. The locations of the properties investigated are shown by symbol and number on the accompanying Minerals Industry Survey map. The symbol refers to the principal or predominating metal. The number designates the property referred to in the Minerals Industry Survey table that accompanies the map. These tables provide summarized data on properties or deposits investigated and on some prospects about which very little information is available.

Warm Springs District

The Warm Springs district embraces the Maiden area, on the west side of the Judith Mountains, and the Gilt Edge area, near Gilt Edge, on the east side of the Judith Mountains (fig. 3). The larger mines in the Maiden area are

within 2 or 3 miles of the old town of Maiden. Three of these mines - the Spotted Horse, Cumberland, and the Maginnis - were the principal gold and silver producers during early operations. The mines near Gilt Edge later became prominent.

The ore deposits in the Maiden area occur principally as veins and as replacements in limestone along and near the contact with syenite porphyry. In general, the ores contain free gold and gold tellurides, along with some sulfides, and usually are associated with a purple-colored fluorite in a quartz, calcite, and a brecciated, altered, limestone gangue. Some of the deposits contain copper, lead, and zinc sulfides and their oxidation products.

In the Gilt Edge area, the ore deposits occur mainly as extensive replacements in limestone and in the altered contacting syenite porphyry. The ores contain no visible sulfides, tellurides, or gold; the gold is exceptionally fine in size, possibly in colloidal form (5). It may be present as an unidentified complex compound. Some of the ores, particularly in the lower levels, contain bitumen, which necessitates roasting them prior to cyanidation.

It has been estimated roughly that the total value of the metals recovered from ores from the Warm Springs district to 1914 was not less than 7 million dollars (25). Total metal-production records for the Warm Springs district before 1932 are not available. From 1932 to 1947, inclusive, the district is credited with a production of gold, silver, copper, and lead valued at \$60,091, divided as follows: 1,291.01 ounces gold valued at \$36,989, 30,325 ounces silver valued at \$21,824, 8,339 pounds copper valued at \$1,002, and 5,787 pounds lead valued at \$275 (28). No zinc is reported, probably because the zinc contained in the ores shipped to the smelters was not paid for. During this period, production was entirely from ores mined by lessees and prospectors.

Maiden and Gilt Edge are readily accessible by roads during the greater part of the year. However, roads to the outlying mines at higher elevations usually are closed to vehicular traffic from November to May.

Enough water for small mining and milling operations generally was available in the district; it was obtained mainly from springs at higher altitudes and was brought to the mines through pipe lines. Some mines obtained an additional supply from their underground workings.

Timber suitable for general mining purposes is available near the mines in the Maiden area. Forest fires had destroyed large areas of timber in the Gilt Edge area; consequently, timber had to be hauled for greater distances.

Spotted Horse (Au-Ag)

The largest individual producer in the Warm Springs district is reported to have been the Spotted Horse mine. This mine is 1 mile due east of the town of Maiden, on the west side of Maiden Canyon. The property was located in 1881; it was acquired in 1883 by P. W. McAdow, and was worked successfully by him for several years (34). Between 1891 and 1901, the mine was operated more or less successfully by seven different owners (26). In 1900, it was operated by the Johanna Gold Mining Co. (24). It was then idle until 1909,

when 23 tons of ore was mined and shipped by lessees. In 1910 the property was acquired by the Cumberland Gold Mining Co., which, in turn, leased it to Coolidge, Bryant, and Associates, who operated the mine on a small scale from 1912 to 1916 (26). From 1917 to 1935, a few hundred tons of ore was mined and shipped by various lessees. The mine has been idle since 1936. The property, consisting of the Spotted Horse and Kentucky Favorite claims, now is owned by the St. Paul & Montana Mining Co. of St. Paul, Minn.; it is under option to Mrs. Margharite F. McLean, Lewistown, Mont.

No early-day mine production records are available. Weed reports the total production up to 1896 was not less than \$1,500,000 (34). Total production up to 1902 was estimated to have been about \$3,000,000 (5). Production, from 1909 to 1935, inclusive, is reported to have been 16,277 ounces gold, 14,925 ounces silver, and 206 pounds copper from 17,639 tons of ore (28).

According to Corry (5), the ore at the Spotted Horse mine has been found in three geological environments - in a fissure vein along the contact between syenite porphyry and massive Carboniferous limestone; in replacement bodies along bedding planes in the limestone; and in replacement bodies in the porphyry. Numerous veinlets extend away from the main fissure and penetrate the country rock on each side. The ore bodies were irregular in form both laterally and vertically; they ranged in size from narrow stringers to bonanza bodies up to 80 feet in maximum width. The oxidized zone extended irregularly to below the 400-foot level. Brecciated limestone or crushed and highly altered porphyry, calcite, chalcedonic silica, and fine-grained or earthy purple fluorite constitute the gangue in which gold occurred free and in the form of *sylvanite* and possibly other tellurides, along with some sulfide minerals (5).

First development of the deposits was by adits and other shallow workings. A two-compartment shaft was sunk later to a depth of 450 feet. Levels were driven from this shaft, and eventually a winze was sunk 135 feet below the 450-foot level. The No. 1 level, 100 feet below the shaft collar, was driven south and east and opened two ore shoots along the contact. Several thousand feet of other development work was done and other ore shoots were discovered. Small stringers of deep purple fluorite, locally yielding rich pockets of gold, were mined. Six ore shoots were mined on eight levels. Ore shoot No. 4, on the 100-foot level, yielded ore assaying \$10 in gold a ton. One ore shoot mined on the eighth level, driven from the winze, yielded 850 tons of ore assaying \$22 a ton gold (5). No further work has been done from this level to determine the possible continuity of the ore bodies to greater depth or laterally along the contact.

During the first 10 years or so of operation, the ores were treated in a small stamp mill, which formerly had been operated at the Collar mine. About 65 percent of the gold in the ore was recovered by amalgamation. Vanner concentrates containing tellurides and sulfides accounted for about 15 percent of the total recovery by this mill. Tailings were impounded. A 40-ton mill and cyanide plant were installed in 1896. Cyanidation of the tailings extracted 95 percent of their average \$12 gold content (35).

The shaft and main adit were closed by caving, and all underground workings were inaccessible when visited in 1948. The mill was dismantled about 1935 and moved to the North Moccasin Syndicate property. Virtually all equipment has been removed from the property, and no buildings remain, except several old cabins.

The contact along which the Spotted Horse ore bodies occur extends northeasterly into the Cumberland mine, where extensive workings were opened and a large production was made from essentially similar ore bodies. The same contact is exposed in the workings at the Maginnis mine, about half a mile southwest of the Spotted Horse.

Maginnis (Au-Ag-Pb)

The Maginnis mine is at the eastern or upper end of the old town of Maiden and just west of the divide between the headwaters of Warm Spring and Maiden Creeks. Organized in 1881, the Maginnis Mining Co. purchased the Montana and Oro Cache lodes. A 10-stamp mill was erected and operated successfully until 1897. When base ores were encountered at depth, the mine was abandoned (34). The Conrad-Stafford Co., Great Falls, Mont., owned and operated the property from 1904 to 1906 (35). In 1907 it was leased to the Gold Reef Lease Mining Co. (33). This company remodeled the mill, erected a cyanide plant, and operated the mine until 1914. The mine was operated more or less continuously by various lessees until 1924. From 1925 to 1940 operations by lessees were intermittent. The mine has been idle since 1940.

When visited in 1948, both of the main adits and the old shafts were caved; all mine workings were inaccessible. The Maginnis properties, consisting of the Montana Lode, Holter Placer, Oro Cache Lode, Oro Cache Extension Lode, and the Oro Cache Millsite, now are owned by Helen E. Wieglanda, Route 3, Lewistown, Mont.

The production made by the Maginnis mine for the years between 1881 and 1899 is not of official record. It has been reported, however, that production during that period was about \$1,500,000 in gold and silver (26). Officially reported production from 1904 to 1940, inclusive, was 18,674 ounces gold, 24,255 ounces silver, and 21,807 pounds lead from 34,883 tons of ore (28). It is possible that the lead reported actually came from the Black Bull (Globe) claim, which formerly was owned by the Maginnis Mining Co. The South shaft was sunk on the Montana claim near the divide before 1897. It is reported that about 1,500 tons of lead-silver ore averaging 60 ounces silver a ton was mined from this shaft at one time and shipped to a smelter at Wickes (34).

The main mine was worked through two adits, one about 300 feet long and the other about 1,450 feet. A winze was sunk for 225 feet from the lower adit at a point about 800 feet in from the portal. Several levels were driven from the winze. Up to 1910 about 9,000 feet had been developed (32).

The ore bodies were similar in character to those in the Cumberland and Spotted Horse mines. They occurred mainly in a fissure vein along the contact of Carboniferous limestones with the Gold Hill intrusive mass of syenite porphyry and as replacement bodies in the limestone. Numerous large cavities were encountered in the limestone; one of these was more than 150 feet deep (34).

The gold occurred free and as tellurides associated with sulfides in a gangue of silicified limestone and porphyry, calcite, and fluorite. The ores resembled those of Cripple Creek, Colo., Mercur, Utah, and the Little Rocky Mountains of Montana. (34).

All of the ores mined above the lower adit level were oxidized. Oxidized ore was found in the winze below the adit, some of which assayed as high as \$1,500 a ton in gold and silver. In the lower levels, the ore contained a small amount of copper sulfides. It is reported that ore was mined over a length of 150 feet on one of the levels driven from the winze. Some of this ore, containing \$15 to \$20 a ton in gold and silver, was milled; some high-grade ore was shipped to the smelters (26) (35). According to George E. Wieglanda, Lewistown, Mont., a 3-foot vein, encountered on the lowest winze level and claimed to assay \$16 a ton in gold and silver could not be mined because of a heavy flow of water. No ore was mined below water level. The drifts along the contact west from the winze on all levels encountered a strong fault, beyond which no ore was found.

Cumberland (Au-Ag)

The Cumberland mine is about 1 mile east of Maiden and about half a mile northeast of the Spotted Horse mine. It was located in the 1880's, but little work was done until after 1904, when it was leased and bonded to Peter Rosso and Oscar Stephens (35) (36). Between 1910 and 1915 the mine was owned and operated by James Breen of Spokane, Wash. Since 1916, the Cumberland, Cumberland No. 2, Buffalo, North Pole, and North Kentucky claims, comprising the Cumberland group, have been owned by the Cumberland Mines Syndicate. Trustees for the Syndicate are C. R. Fowler, D. B. Noble, and Margharite F. McLean, Lewiston, Mont.

In 1916 the mine was leased to Coolidge, Bryant, Wieglanda, and associates, who operated it until 1918. Except for some cleaning up around the old Cumberland mill in 1923, no work has been done on the property since 1918 (18). The old mill buildings were destroyed by fire in September 1948.

No production data for the years before 1903 are available. Production from 1903 to 1923, inclusive, is reported to have been 15,236 ounces gold and 12,771 ounces silver from 40,238 tons of ore (28).

Ore in the Cumberland mine occurred in a vein along the contact of Madison limestone and the eastern edge of the Gold Hill syenite porphyry and in a large replacement body mainly in the porphyry near the contact. The gold occurred free and as sylvanite; it usually was associated with the fluorite. The gangue in the vein consisted of brecciated limestone, crushed and highly altered porphyry, calcite, chalcedonic silica, and fine-grained purple fluorite. The large oval replacement deposit, consisting of highly altered porphyry and brecciated limestone traversed by a network of small fractures, was the principal source of the ore mined. The gold in this replacement deposit occurred free or in the form of tellurides along with minor sulfides associated with crystalline masses and earthy lumps of pink and purple fluorite (5).

When first operated in 1904-06, only high-grade ore was mined and shipped. During this period a shaft was sunk on the vein to a depth of 183 feet. From this shaft, three levels were driven to develop the main replacement ore body. This replacement ore body is reported to have been about 100 feet wide on each of the three levels. On the third or bottom level, the area stoped was 72 feet long, 45 feet wide, and 32 feet high without reaching the walls (35). In 1906 the shaft was sunk to the 250-foot level (31). In 1909 Rosso shipped five cars of ore, which netted nearly \$25,000. Most of this ore was mined from an intermediate level about 80 feet below the surface (35). Later, an adit was driven 900 feet to connect with the bottom of the shaft, and a 100-ton mill and cyanide plant were constructed (35).

The mill started operating May 1910 on 2,100 tons of dump material that averaged \$11.08 a ton in gold and silver. Mine-run ore in August 1910 averaged about \$12 a ton, and mill tailings assayed \$0.66. A 5-day leaching made a recovery of about 93 percent (35). When operated by lessees in 1916-18, most of the ore mined was treated in the Spotted Horse mill; the average recovery amounted to about \$15 in gold and silver a ton (13).

A drift along the porphyry-limestone contact southwest from the main ore body on the 250-foot level encountered a fault that cut off the ore. No exploratory work was done west of the fault or below the 250-foot level.

Ore similar to that found at the Cumberland was mined along the porphyry-limestone contact on the 585-foot level of the Spotted Horse mine, approximately half a mile to the southwest.

Tail Holt (Au-Ag)

The Tail Holt mine is on the northeast side of Big Grassy Peak, about 3 miles northeast of Maiden. The claim was located by a Mr. Sellers in 1911; it was worked for about 6 months and then abandoned (5).

In 1927 the property was reopened by Coolidge, Bryant, Wieglanda, and others. One car of unusually rich ore was hauled to Brooks and shipped to the smelter (5). During the next 3 years, several hundred feet of drifts and crosscuts were driven; some good ore was developed (20) (21) (22). A mill and cyanide plant were constructed. The mine and mill were operated until 1934, when operations ceased. Production data from the time of its discovery in 1911 to 1926 are not available. From 1927 to 1934, inclusive, reported production was 1,166 ounces gold and 647 ounces silver from 2,961 tons of ore (28).

In 1948 the adits were caved; the mine workings were inaccessible. The claim now is held by location by George E. Wieglanda, Route 3, Lewistown, Mont.

Free gold and tellurides, usually associated with purple fluorite in a quartz-calcite gangue, occurred in narrow seams and veins 2 to 3 feet wide along fractures in syenite porphyry. Some limonite-filled veinlets extending into the silicified porphyry walls contained as much, or more, gold than the main veins (5). At least one of the veins mined on the Tail Holt property extended into the Silver Bullion property, which adjoins it on the south.

Silver Bullion (Au-Ag)

The Silver Bullion mine, otherwise known as Peter Rosso's mine, is at the northeast end of Grassy Peak, about 1-3/4 miles northeast of Maiden. It adjoins

the Tail Holt mine on the southwest. Located in the 1890's by Peter Rosso, a shaft was sunk on the vein to a depth of 150 feet by use of a horse whim. According to J. R. Clarke, Lewiston, Mont., this shaft was sunk later to the 200-foot level, from which a drift was driven 90 feet southward. A heavy flow of water encountered at a fault in the face of the drift stopped work through the shaft. An adit drift about 50 feet lower in altitude than the shaft collar then was driven to and beyond the shaft. Later, another adit was started to connect with the bottom of the shaft. It was advanced 173 feet, still 150 feet short of goal, when all work ceased.

The claim now is owned by Susie C. Rosso, c/o Pearl Riley, Beatty, Nev. (one-third); F. C. Lambert, Beatty, Nev. (one-sixth); Milo Skaro, Superior, Mont. (one-sixth); and Mrs. John R. Clarke, Lewiston, Mont. (one-third). When visited in 1948, the adits were closed at their portals, and the shaft had caved.

Production data on ore mined through the shaft are not available. Production from 1917 to 1933 is reported to have been 16 ounces gold and 2,090 ounces silver from 46 tons of ore (28). Included in this production was 17 tons of ore sorted from the mine dumps in 1933 by J. R. Clarke. This ore contained 3 ounces silver. The mine has been inactive since 1933.

The ore occurred in a replacement vein along a fracture in altered syenite porphyry. Silver minerals, probably in the form of sulfides and tellurides, with minor amounts of other sulfides, were associated with crystalline and earthy purple fluorite, azurite, and chrysocolla in an altered porphyry gangue (5). Silver-bearing minerals predominated near the surface on the Silver Bullion claim. Gold-bearing minerals predominated in the same vein at greater depth on the adjoining Tail Holt claim, where drifts were driven up to the Silver Bullion end line.

Globe or Black Bull (Pb, Ag, Zn, Cu)

The Black Bull claim was the second lode claim located in the Maiden area. It is on the south side of the divide, between Alpine Gulch and Virgin Gulch, about 1-1/4 miles south of Maiden. It was acquired soon after its location by the Maginnis Mining Co. and patented as the Globe. Oxidized ores were hauled to the Maginnis mill during the first operations. Lead-zinc sulfide ore was encountered at depth; some of this ore was smelted at Maiden; some was shipped. These ores could not be mined profitably because of their zinc content. In 1904 the mine was owned by the Conrad-Stafford Co. of Great Falls, Mont. The property was purchased for taxes by Abbott and Sutter about 1934. Later, the Sutter interest was acquired by R. N. Winston. The Globe property, consisting of the patented Globe claim and four unpatented adjoining claims, is now owned by Granville S. Abbott, Route 3, Lewistown, Mont., (one-third), and R. N. Winston, 512 Evelyn St., Lewistown, Mont., (two-thirds). In the fall of 1948 the property was leased to Harry Lewon of Lewistown, Mont., who reopened one of the old shafts. Some good lead carbonate and sulfide ore was found in the side of the shaft. About 100 tons of this ore has been mined and shipped by Lewon.

No production records are available on ore mined before 1936. Between 1936 and 1942 production is reported to have been 28 ounces gold, 825 ounces silver, and 5,016 pounds copper from 69 tons of ore (28).

The ore occurs along the contact of a sill or dike of syenite porphyry and thin-bedded Madison limestone; also, in a pipe or chimney in the limestone a short distance north of the contact, and as replacement deposits in and alongside of a narrow fracture in the porphyry south from the contact. The oxidized lead, zinc, and copper ores that outcrop over the chimney in the limestone and on the contact were mined first through open-cuts and shafts. Later, three adits were driven. The lower adit, about 160 feet long, reached the porphyry-limestone contact about 115 feet west from the bottom of the shaft sunk on the contact. About 80 feet in from the adit entrance, a small vein containing some high-grade copper sulfide ore was intersected. This replacement vein, entirely in the porphyry and roughly paralleling the contact, pinched out 15 feet west and about 50 feet east of the adit.

The contact and replacement ore bodies contained galena, sphalerite, pyrite, and chalcopyrite, together with their oxidation products. The gangue was silicified limestone, altered porphyry, calcite, and quartz. The principal mineral in the copper replacement vein was mainly chalcocite along with some copper oxides, carbonates, and silicates.

According to an assay certificate in the possession of G. S. Abbott, Lewistown, Mont., the ore in one shipment contained 0.07 ounce gold, 3.9 ounces silver, 32.4 percent lead, 2.14 percent copper, and 29.4 percent zinc.

When visited in 1948, the shaft sunk on the chimney of ore in the limestone was open to a depth of about 50 feet, although the shaft timbers had fallen in. The surface workings on the contact and the upper adits were caved. The lower adit was in fair condition; the east drift along the contact was open to the bottom of the shaft. The drift on the copper vein was caved about 50 feet east of the adit.

War Eagle (Pb-Zn)

The War Eagle claim, the first lode claim to be located in the Maiden area, was located in 1880 by David Jones and Joe Anderson. It is about 1 mile south of Maiden on a ridge extending northwestward from Pekay Peak. In 1885 the claim was owned by Jones, Anderson, McAdow, and Dexter (27). In 1905 it was owned and operated by Burr and Stuart. Later, D. J. Burr became sole owner. The claim, now owned by the D. J. Burr Estate, c/o J. A. Walker, Lewistown, Mont., has been leased to Walter Lehman, Lewistown, Mont. Data on production prior to 1910 are lacking. From 1910 to 1913, inclusive, production is reported to have been 4 ounces gold, 510 ounces silver, 2,348 pounds copper, 74,464 pounds lead, and 159,295 pounds zinc from 340 tons of ore (28). The mine has not been worked since 1913.

The ore bodies on the War Eagle claim occur as irregular replacements in limestone overlying syenite porphyry; as a chimney or pipe at the limestone-porphphyry contact; and as a brecciated zone in the syenite porphyry distant from the contact. The ores contain galena, sphalerite, and their oxidation

products. The syenite porphyry on both sides of the brecciated zone is leached and altered.

The mine was developed by three adits and by an inclined shaft sunk on the chimney of ore at the limestone-porphyry contact. The upper adit connected with the shaft at a depth of about 80 feet. Numerous irregular ore bodies in the limestone were mined through this adit. Some oxidized ore was hauled to the Spotted Horse mill for treatment. Some lead ore was smelted in the small lead smelter at Maiden. In 1911, when the mine was operated by Burr and Stuart, some lead-zinc ore was shipped to the Ozark Mining & Refining Co. in Kansas (11).

The middle adit was driven through syenite porphyry to the limestone contact, along which some drifting was done. A winze was sunk to a depth of 70 feet below the adit level. A lower adit was driven a short distance into the porphyry but was never completed to the contact. The ore mined from the discovery shaft is said to have carried up to 80 ounces silver a ton (27). A 4-1/2-foot Bureau of Mines sample cut across the central, more mineralized part of the brecciated zone exposed in the middle adit assayed 3.0 percent lead, 6.1 percent zinc, 0.54 ounce silver, and a trace of gold. Another Bureau of Mines sample taken in 1942 from the same brecciated zone at approximately the same place assayed 0.1 percent lead, 4.4 percent zinc, 0.60 ounce silver, and 0.015 ounce gold.

The ore body on which the winze was sunk is reported by Lehman to be 4-1/2 to 5 feet wide at the bottom of the winze and to average about 2 percent lead and 6 to 8 percent zinc, with small amounts of gold and silver.

When visited in 1948, the water level in the winze was about 15 feet below the adit level. The discovery shaft was caved, but all three adits were open and in good condition. Some of the old stopes and drifts off the upper adit were accessible.

Allen Silver (Ag-Au)

The Allen Silver group of unpatented claims, consisting of the Silver Dike, Hopeful, Blue Star, Prince Albert, and Velvet Lode locations, is on a long ridge about 1 mile south from the Maiden school and about 7-1/2 miles east of Brooks. The Silver Dike, the most westerly claim, formerly was known as the Silver Queen; the Hopeful, as the Paradigm; the Velvet, as the Argentite; the Prince Albert, as the Fluorite; and the Blue Star, as the Paragon. The claims now are owned by W. G. Allen, Lewistown, Mont.

These claims, first located in the early days, have been worked at various times by John Riley, Montgomery and Lossinger, Wm. Hanna, W. G. Allen, and others. Production data for the years prior to 1900 are not available. The following tabulation gives the reported production from the claims from 1901 to 1947 (28).

Claim	Years reported	Ore, tons	Gold, ounces	Silver, ounces
Silver Dike (Silver Queen).....	1922-39	669	37	16,402
Hopeful (Paradigm).....	1935-36	96	2	3,107
Blue Star (Paragon).....	1935	3	-	20
Prince Albert (Fluorite).....	-	-	-	-
Velvet (Argentite).....	1935-40	507	24	8,444

The ore on all of the claims occurs in a silicified brecciated band or bands, 2 to 12 feet thick, between remnants of Madison limestone and the underlying Alpine intrusive mass of syenite porphyry. The bands dip 5° to 25°, west on the Silver Dike claim, north on the Blue Star, and east on the Velvet claim. Silver minerals, probably as sulfides or tellurides with some gold, occur in a calcite, quartz, and fine-grained pink or purple fluorite gangue.

Ore has been mined mainly from open-cuts and pits. Some ore has been mined through shallow adits driven along the breccia bands and from inclined shafts. Several thousand feet of underground development work has been done.

The sorted ore shipped contained about 22 ounces silver a ton. According to Allen, 280 samples taken from various places on the property averaged about 18 ounces of silver a ton. Cyanidation tests on coarsely crushed ore indicated a recovery of about 60 percent of the contained silver. The deposits are exposed at or near the surface at the western and eastern ends of the area, where they could be mined to a considerable extent by open-pit methods.

When visited in 1948, most of the adits and open cuts were closed by caving and sloughing; however, a number of these workings were accessible for inspection.

Three Bureau of Mines samples assayed as follows:

Sample and location	Ounces per ton	
	Gold	Silver
Sorted ore on dump, Silver Dike claim.....	0.07	43.22
Dump sample near inclined shaft, Blue Star claim.....	.03	1.41
Dump sample near open cut, Prince Albert claim.....	.02	2.36

Florence or Get Even (Ag-Au)

The Florence claim, located in 1881 by John Kemper, was later patented as the "Get Even" by John McFatrigh. It is on the west side, and near the top, of Crystal Peak, about 2 miles east of Maiden. Although extensively worked in the early days, only high-grade ore was shipped; low-grade ore was left on the dumps. One lot of 25 tons of ore was shipped to the smelter. Returns from 17 tons of this ore are reported to have been about \$9,000 (34). The mine has not been worked to any extent since 1896. The dumps have been sorted over several times and have yielded a small amount of ore. In 1924, 7 tons of sorted dump material, said to have been shipped by W. G. Allen, yielded 3 ounces gold and 309 ounces silver (28).

The Get Even, together with the adjoining Edward and Hendricks claims, now are owned by Harry F. Goll, Milwaukee, Wis. (two-thirds), and Clifford R. Parsons, Lewistown, Mont. (one-third). During the summer of 1948, the old road to the mine was regraded by a bulldozer. This bulldozer was to be used for turning over the old mine dumps to permit further sorting.

The ore bodies on the Get Even (Florence) claim are replacements in thin-bedded limestones, along both contacts of a narrow syenite or tinguaitite porphyry dike. The ore minerals are mainly silver sulfides or tellurides, associated with copper oxides and silicates, and purple fluorite. The gangue is altered porphyry, silicified limestone, calcite, and quartz. The ore bodies along the dike spread out irregularly into cavities, vugs, and seams in the limestone. The ore minerals occur also in thin seams and lenses along limestone bedding planes at a considerable distance from the dike.

Several short adit drifts were driven on seams in the limestone, and some ore was stoped therefrom. Farther south, another adit was driven through the limestone to intersect the dike. From the intersection, drifts were driven north and south. A winze was sunk about 50 feet below the drift. Some stoping was done above and below the drifts.

When visited in 1948, the main adits and drifts were open and in good condition. The winze was open but not in condition to permit inspection.

Pilgrim (Ag)

The Pilgrim claim is on the west side of Crystal Peak, about one-fourth mile west from the Florence (Get Even) claim and about 2-2/10 miles northeast of Maiden. It was located in the 1880's; considerable development work was done. The claim was abandoned subsequently. Some years later it was included within the boundaries of patented claims Ninty-Eight and Ninty-Nine, now owned by Helen E. Wieglanda and A. H. Sellers, both of Lewistown, Mont.

A narrow quartz vein occurs in limestone at a considerable distance from the limestone-porphyry contact. The ore minerals are chiefly silver sulfides or tellurides associated with small amounts of purple fluorite. Two shafts, 60 feet and 20 feet deep, were sunk on the vein. A 20-foot drift was driven from the bottom of the 60-foot shaft. Several trenches and open cuts were dug. No production data are available. According to George Wieglanda, who formerly leased the property, a small amount of rich silver ore was produced.

In 1948 the 20-foot shaft and the trenches were caved or badly sloughed. The 60-foot shaft was open, but the shaft timbering had fallen in.

Collar (Ag)

The Collar mine on the east side of Collar Gulch, about 2 miles east of the old town of Maiden, was the first mine worked extensively in the Maiden area. The ore deposit was discovered in August 1880; the claims were located in September of that year by C. C. Snow, E. A. Irvine, Charles Bessey, Charles Young, J. R. Kemper, and F. T. McPartlan. The mine was developed by the Collar Mining & Improvement Co. C. W. Mead, of Omaha, Nebr., was president; W. M. Curtis, resident agent and manager; and C. C. Snow, superintendent. An adit

350 feet long was driven through limestone into the Crystal Peak dome near the divide between Collar and Maiden Gulches. A shaft was sunk 190 feet and connected with the adit. Drifts were driven on the 70 and 120-foot levels of the shaft and on the adit level. A 20-stamp mill was erected but operated for a short time only. The mill contained 850-pound stamps, 12 pans, and 6 settlers. In 1881 a part interest in the property was sold to the Omaha Smelting Co. on condition that the company pay \$30,000 in cash, expend \$8,000 for installing additional equipment, issue stock, and deliver a stipulated amount of that stock to Snow, Irvine, and associates. In February 1884, General Mead, S. J. Eaton, and others, of St. Paul, Minn., acquired control of the property, but it was attached by A. H. Wilder of that city. In May 1885 the mine and mill were sold by the sheriff to Eugene Smith for \$7,550 (27). Smith sold the mill and equipment to P. W. McAdow, who moved the equipment to the Spotted Horse mine (34). The mine then was abandoned; it has been inactive ever since. No production records are available. The property is now owned by Helen E. Wieglanda and A. H. Sellers, Lewistown, Route 3, Mont.

Weed states the ore appeared to be a broken and silicified limestone containing small amounts of silver minerals. In 1897, quartz containing silver sulfides was found on the Collar dump (34). In 1948 all mine workings were caved and inaccessible.

Black Hawk (Au-Ag)

The Black Hawk group of six unpatented claims is near the top of the divide between Alpine Gulch and Virgin Gulch, about 1-3/4 miles southwest of the old town of Maiden. The claims were located in the early 1880's. After being abandoned, they were located by Tom Pitman. In 1938 they were located by George O'Brien of Lewistown, Mont. In 1948 they were owned jointly by O'Brien and George Brundage, Billings, Mont. A small amount of ore is reported to have been produced in the early days, but no production data are available.

The underground workings consist of a 50-foot adit driven along the contact with a 20-foot winze and a lower 80-foot adit in syenite porphyry. In 1948 the 50-foot upper adit was partly open but in bad condition; the lower adit was closed by caving.

The ore deposit on the Black Hawk claim occurs at the contact of syenite porphyry and an overlying remnant of shaly limestone. Both the limestone and the porphyry at the contact are brecciated, highly altered, and knolinized. Gold occurs with small amounts of copper oxides and carbonates, cerussite, smithsonite, and fine-grained specular hematite. Where exposed in the 50-foot adit drift, the altered zone is 2 to 8 feet wide. A Bureau of Mines sample of oxidized material on the dump of the upper adit assayed 0.01 ounce gold and 0.67 ounce silver a ton.

New Year (Au)

The New Year mine is near the top of the ridge at the headwaters of New Year Creek, about 9 miles southeast of Brooks. The New Year and Old Bach claims were owned in 1897 by Harmon and Norman. A small amount of development was done. In 1898, a small mill and cyanide plant were constructed. Cyanidation was unsuccessful because the ore was not ground fine enough (34). In 1902

the mill was enlarged and the mine was developed by a 500-foot adit. Litigation stopped operations. In 1912 the property was owned and operated by the Rheingold Mining Co.; of which A. S. Wright was general manager. Under his direction, the old mill was torn down and a new 300-ton capacity mill and cyanide plant was erected; a 1-mile aerial tramway was constructed between the mine and mill; a coal seam, outcropping at the mill, was developed to provide fuel for the power plant, and a new 10-drill compressor was installed (33). About 10,000 tons of ore was mined and milled during 1911 and 1912 (11). Recovery from this ore is reported to have been 206 ounces gold and 11 ounces silver (28). The equipment was sold and the property subsequently abandoned by the company. The property now is owned by Fergus County. In 1948 the adits were caved; all underground workings were inaccessible.

The ore occurred along the under contact of an intrusive sheet of syenite porphyry with limestone (34). Several ore bodies are said to have been found at different places within a distance of nearly 1 mile along the contact. The ore bodies are similar to those at Gilt Edge and consist of highly altered silicified limestone containing gold, either as free gold in an extremely fine form, possibly colloidal, or as some unidentified compound. According to Weed (34), the ore was reported to average about \$14 in gold a ton. If the ore contained the values reported, it is probable that the milling and cyanidation methods followed were not properly adapted to the ore treated.

Justice (Pb-Ag-Au)

The Justice claim was located by Joe Anderson in 1880 and was acquired soon after by P. W. McAdow. The claim extends across the heavily timbered ridge about one-fourth mile south of the old town of Maiden. First development work was done for McAdow under the direction of Adam Sarger; a shallow shaft was sunk an adit drift about 50 feet long was driven, and some ore was mined. Later, an adit 350 feet long was driven at a lower elevation (36). About two-thirds of the distance in from the portal, an inclined raise was driven 158 feet to the surface (36). According to George E. Wieglanda, Lewistown, Mont., the raise did not connect with the former workings, apparently being on a separate ore body. The Justice claim now is owned by Mrs. Marian A. McAdow of Asprey, Fla.

No data regarding the early-day production are available. Production during 1909, when the raise was driven, is reported to have been 1 ounce gold, 251 ounces silver, and 10,573 pounds lead from 10 tons of ore (28).

The ore bodies occur as replacements in limestone at or near the contact of the limestone and underlying syenite porphyry. The ore consists mainly of galena and cerussite containing silver and a small amount of gold.

No work has been done on the claim since the raise was driven. In 1948 the adits were caved; the workings were inaccessible.

Matthews and Last Chance No. 2 (Pb, Ag, Au)

The Matthews and Last Chance No. 2 claims are on the top of Gold Hill, about three-fourths mile east of Maiden; they were located in the early 1880's.

Little is known of their early history. About 1920 they were owned by a Mr. Brown of Chicago, Ill. Present owners are R. N. Winston, Lewistown, Mont., and Mrs. Elys M. Sutter, 2966 Passmore Drive, Hollywood, Calif.

The ore bodies are replacements in and along the contacts of a phonolite dike that cuts the main mass of syenite porphyry. The ore minerals are pyrite, galena, and sphalerite, with their oxidation products. In addition to numerous cuts and trenches, a shaft was sunk on the deposit to a depth of about 80 feet. About 20 feet of drifting was done from the bottom of the shaft. The workings were inaccessible in 1948.

In 1940, 20 tons of ore is reported to have been shipped. This ore contained 25 ounces gold, 78 ounces silver, and 1,932 pounds lead (28).

Great Falls and Judith Mining Co. (Pb-Zn)

The holdings of the Great Falls and Judith Mining Co., consisting of a group of nine patented lode claims, are on the east side of the divide between Alpine Gulch and Virgin Gulch, about one-fourth mile south of the Globe or Black Bull mine and about 2-1/2 miles by road northwest of Gilt Edge.

Little can be learned of the early history. Most of the claims were located under different names in the early 1880's (27). Not much work was done until about 1900, when two adits, 300 and 700 feet long, were driven to get under ore bodies found at or near the contact of syenite porphyry with overlying limestone. In 1942 several of the claims were leased to Walter Lehman of Lewistown, Mont., but little work was done. The property, consisting of the Ball, Daisy, Alta, New York, Cave No. 2, Evening Star, Eureka, Sunflower, and Golden Rule lode claims, now is owned by the Great Falls & Judith Mining Co., c/o Dudley Crowther, P. O. Box 1904, Great Falls, Mont.

The ore is a complex mixture of galena, sphalerite, pyrite, chalcopryrite, and their oxidation products and contains small amounts of gold and silver. The ore bodies occur mainly as replacements in limestone near its contact with syenite porphyry. The discovery adits on the Cave No. 2 and the Alta claims followed narrow veins along the porphyry-limestone contact. No ore was encountered in the lower adits, which were driven entirely in syenite porphyry.

Assay reports on samples taken in 1942 by a Bureau of Mines engineer were as follows:

Location of sample	Width, feet	Ounces per ton		Percent	
		Au	Ag	Zn	Pb
Evening Star (dump).....	-	0.025	30.10	31.7	5.9
Alta claim (vein).....	0.5	.02	5.25	30.3	30.2
Cave No. 2 claim (vein).....	1.0	Trace	2.50	4.6	1.5

No ore has been shipped from any of the claims. When visited in 1948, the workings were caved and inaccessible.

Western Mines Corp. (Ag)

The Western Mines Corp. was incorporated in Montana December 7, 1937. The corporation was organized to work the Florence, Silver Bell, and Prince

groups of 12 unpatented claims in Devil's Canyon, about 1-1/2 miles south of the Maiden-Brooks road, about 8 miles southeast of Brooks (30). The Silver Bell claim adjoins the Silver Dike claim of the Allen Silver group on the southeast.

A tunnel about 200 feet long was driven through a narrow ridge, cutting a silicified brecciated zone in limestone. Numerous surface cuts and pits were excavated in the brecciated zone where it outcropped on the side of the ridge. Construction of a 50-ton flotation mill was begun (30). All operations ceased in November 1940. The mill and equipment were attached by the U. S. Department of Interval Revenue. According to Howard Gee, Lewistown, Mont., former attorney for the corporation, the corporation has been liquidated.

The amount of ore mined from the Silver Bell claim before 1924 is not known. Since 1925 production is reported to have been 4 ounces gold and 1,936 ounces silver from 94 tons of ore (28). It is claimed that 20 tons of this ore containing 1 ounce gold and 454 ounces silver was mined during the time the Western Mines Corp. was in possession. The ore on the Silver Bell claim is similar to that found on the adjoining Allen Silver group. Silver minerals in the brecciated zone occur as sulfides or tellurides, usually associated with purple fluorite, calcite, and quartz.

When visited in 1948, the tunnel through the ridge was in good condition. Most of the surface cuts and pits had caved. The frame of the mill building and numerous cabins nearby were in fair condition.

Bolivia (Hamilton Copper Prospect) (Cu)

The Bolivia claim is one of 17 unpatented claims on Judith Peak, about 4 miles north of Maiden. Copper mineralization was discovered on this claim about 1915 by R. S. Hamilton, who excavated several small pits and trenches. In 1942, H. F. Coll acquired an interest. An adit was driven 130 feet into the mineralized area below the discovery cuts. In 1945 the Bureau of Mines drilled a 188-foot diamond-drill hole from the face of the adit to crosscut the rhyolite-granite porphyry contact to the southwest. No ore has been produced. The property now is held by location by R. S. Hamilton, Lewistown, Mont., and H. F. Goll, Milwaukee, Wis.

The rhyolite porphyry mass of Judith Peak has been penetrated by a granite porphyry intrusive plug south and east of the summit of the peak. Around the plug, mainly in the rhyolite porphyry, is an altered zone containing scattered copper sulfide minerals. On and near the surface, the sulfides have been oxidized. In some places, carbonates, oxides, and silicates of copper have stained the enclosing rocks a faint blue or green. In the adit, small amounts of chalcocite occur in the rhyolite porphyry along minute fracture fillings and as scattered disseminations.

A sample cut across a 25-foot width in the open cut at the portal of the adit during the Bureau of Mines investigation in 1945 assayed: gold, trace; silver, 0.15 ounce; copper, 0.10 percent. A 2-foot sample of a mineralized band in the rhyolite cut near the face of the adit assayed: gold, 0.01 ounce; silver, 0.75 ounce; copper, 2.47 percent. Thirty-five core samples were taken

from the diamond-drill hole. These core samples contained a trace of gold, a trace to 0.30 ounce silver, and 0.02 to 0.12 percent copper.

When visited in 1948, the adit was open and in good condition.

Northern Pacific or American Flag (Cu, Pb, F)

The Northern Pacific claim was located about 1880. It is about half a mile northwest of Judith Peak and near the top of the main ridge, about 4-1/2 miles north of Maiden by rough mountain road and foot trail. Before 1897, two shafts were sunk 50 and 40 feet, respectively, in a vein said to have been about 10 feet wide. The vein consists mainly of quartz and fluorite and contains occasional bunches of galena, with small amounts of chalcopyrite and other sulfide minerals (34). Later, two adits of unknown lengths were driven toward the shafts at lower elevations. Neither of the adits reached the vein.

No ore was shipped, although in 1897, when owned by Anderson and Rhodes, 500 tons of ore valued at \$15 a ton was reported to be on the dumps (34). The claim was abandoned and later relocated as the American Flag. It is now owned by R. S. Hamilton, Lewistown, Route 3, Mont., and Mrs. John Wagner, 1404 Central Avenue, House 4, Evanston, Ill.

The vein is in a phonolite porphyry dike that cuts an older rhyolite porphyry. The vein is reported to have been traced along the surface for over 500 feet. According to Hamilton, the vein in the No. 2 or lower shaft is about 7 feet wide, and contains about 35 percent fluorite. In 1948 the shafts were caved, and the adits were in poor condition.

Horseshoe and Muleshoe (Au-Ag-Cu)

The Horseshoe and Muleshoe claims are in Richy Gulch, a branch of Ruby Gulch about 1-1/4 miles south of the New Year mine and about 7 miles northeast of Lewistown. Their early history is not known. In 1934 they were owned by D. J. Hilger, Helena, Mont., and Mrs. Sarah Stoddard, Lewistown, Mont.; they were leased to W. G. Allen of Lewistown, Mont. During 1934 and 1937, 11 tons of ore containing 7 ounces gold, 10 ounces silver, and 1,751 pounds copper is reported to have been produced from the Horseshoe claim (28). Development included a 500-foot drift, a 75-foot raise, and a 100-foot shaft. The manner in which the ore occurred could not be learned. Similarly named, Horseshoe and Muleshoe claims, Nos. 2957 and 5958, are in the North Moccasin district about 1 mile north of the Kendall; they should not be confused with Horseshoe and Muleshoe claims No. 8981.

Last Chance (Au)

The Last Chance claim No. 10099 adjoins the Cumberland claim at the northeast; it is about 1-1/4 miles northeast of Maiden. It should not be confused with Last Chance claim No. 9992, one of the White and Gilpatrick claims on West Armells Creek, about 3-1/4 miles to the south; or with Last Chance claim No. 8975, which is part of the Accident group owned by Wm. Greshchuk. The early history of the Last Chance No. 10099 claim is not known. It now is owned jointly by the A. H. Sellers estate and by Helen E. Wieglanda, Route 3,

Lewistown, Mont. In 1925 a production of 25 ounces gold and 43 ounces silver from 2 tons of ore was reported (28). No other production data are available. The deposit is a replacement in limestone along or near the contact with syenite porphyry.

Old Nelson (Pb, Ag)

The Old Nelson claim is southeast of the Maginnis mine. It was held for several years by W. G. Allen of Lewistown, Mont. Present ownership is unknown.

According to Allen, the ore body was a pipe or chimney in limestone. The ore was mainly argentiferous galena, sphalerite, and pyrite, with their oxidation products; it assayed about 16 percent lead, 12 percent zinc, 38 ounces silver, and \$12 gold a ton. One 5-ton shipment of ore in 1935 is reported to have contained 1 ounce gold, 183 ounces silver, and 1,250 pounds lead (28). No production data for the years prior to 1935 are available. The mine has not been worked since 1935.

Clara May and Ella (Au)

The Clara May and Ella claims are between the Spotted Horse and the Maginnis mines, about three-fourths mile southeast of Maiden. Nothing is known of their early history. In 1904 they were reported as being owned by Victor Longdon. At that time, about 500 feet of development work had been done, and some high-grade ore had been shipped. One shipment of 28 sacks of ore is reported to have assayed \$160 in gold a ton. Another shipment of 3 tons shipped to Omaha, Nebr., yielded \$300 a ton (36).

The limestone-syenite porphyry contact, along which rich ore occurred in the Spotted Horse mine, is said to cross the Clara May claim and extend into the Ella (36).

Depression (Au, Ag)

The Depression claim is south of the Spotted Horse claim and about 1 mile east of Maiden. Nothing is known of its history or early-day production. In 1948 it was reported to be owned jointly by George Wieglanda of Lewistown, Mont., Lloyd Decker, and Newton Smith, addresses unknown.

A production of 731 tons of ore containing 120 ounces gold and 389 ounces silver was reported during 1935 (28). The extent of the development work or the character of the ore bodies could not be learned. Mine workings now are inaccessible.

Boulder (Ag)

The Boulder claim is on the northwest slope of Pyramid Peak, southeast of the New Year mine, about 4 miles southwest of Maiden. In 1897 it was owned by M. W. Wilson. Weed (34) states that the ore occurred in mineralized black Silurian limestone near a limestone-porphyry contact. Some of the ore was reported by Wilson to assay 100 ounces silver a ton. An adit 300 feet long

was driven through the limestone toward the porphyry; it now is inaccessible. No production records are available.

Black Diamond (Au)

The Black Diamond claim was located in the early 1880's. In 1897 it was owned by J. Dougherty. Present ownership is not known. The claim was on the east side of Crystal Peak about 2 miles east of Maiden. According to Weed (34), the ore deposits consisted of limonite bands in limestone. These bands assayed as much as \$14 a ton in gold. One band of limonite ranged from 18 inches to 2 feet in thickness and appeared to be iron ore of fair quality (34).

Hardscramble (Au)

The Hardscramble claim is in Collar Gulch about 2-1/4 miles northeast of Maiden. Nothing is known of its early history. It now is held by location by George Wieglanda, Lewistown, Mont. Production in 1918 is officially reported as 3 ounces gold, 87 ounces silver, and 105 pounds copper, from 3 tons of ore (28). Data on production before or after 1918 are not available.

Wocasek (Ag)

The Wocasek claim is near the mouth of New Year Gulch, about 2 miles west of Maiden. It was located in the 1880's by J. Wocasek, who shipped small amounts of rich silver ore. The ore body occurred as a small pocket in limestone at a considerable distance from the limestone-syenite porphyry contact (28). No production records are available. Present ownership of the claim is not known.

She (Au)

The She claim was located many years ago. It is near the Spotted Horse mine, about 1 mile east of Maiden. In 1891-92 the claim was worked on a small scale by W. H. Burgess. Development in 1891 consisted of a 50-foot adit and a 30-foot winze sunk from the adit on one ore shoot (23) (24). No other information is available.

Peerless (Au)

The Peerless claim was located in Peerless Gulch in the 1880's by Shields and Nobel. Weed (34) reports that in 1897 it had been prospected by a 30-foot shaft and a 30-foot adit. A narrow vein in limestone near a limestone-porphry contact contains gold, silver, and copper minerals. Six tons of selected ore containing about \$100 a ton in gold and silver was shipped at one time.

Gilt Edge Mines (Au)

The original Gilt Edge claims were located in 1884 by Wilson, Anderson, and Munson, who sold them to Butts, Collins, and Armington. These men erected a crude cyanide mill and operated the mine for a short time, developing a considerable tonnage of low-grade ore. In 1893 the mine was sold to the Ammon-Stivers Mining Co. Under the direction of W. B. Potter, of St. Louis, Mo.,

the mill was rebuilt and the mine developed. Gold recovery in the mill was unsatisfactory. The property was attached by lien holders, who operated the mine and mill until 1897 (34). In 1897 it was acquired by the Great Northern Mining & Development Co. In 1899 a new, modern mill and cyanide plant were constructed nearer to the mine (2). On October 1, 1902, the property was sold to the Gold Reef Mining Co. The mill was enlarged, and roasting equipment was installed (31). Operations by the Gold Reef Mining Co. continued until 1909, when John A. Drake became the owner. Drake leased the property to Badger, Caldwell, Cooper, and Turnbull, who operated under the name Gilt Edge Lease Mining Co. until 1912 (32) (35). After 1912 little work was done on the property. In 1916 the property was leased to Allen, Caldwell, and Turnbull (13). In 1918, 8,200 tons of the tailings from the first mill were re-treated in a cyanide plant specially constructed for this purpose.

The Gilt Edge Mining Corp., in which the Newmont Mining Corp. has an interest, now is owner of most of the former Gold Reef Mining Co. holdings, which consisted of 47 patented and 12 unpatented claims in the Gilt Edge area (30). During 1940 and 1941 this corporation made a complete examination of all accessible workings, sank a new 200-foot winze below the main haulage level, and drove several hundred feet of crosscuts and drifts; some core drilling also was done. When visited in 1948, some of the mine workings were accessible; others were caved.

The ore bodies occur as replacement deposits at or near the contact of the Madison limestone and sills or dikes of syenite porphyry. These ore bodies are mainly in altered limestone, some of which is soft, yellow, clayey material, although most of the altered limestone is hard and siliceous. Ore also extends irregularly into the contacting altered syenite porphyry. At greater depths and in places at or near the surface, ore occurs in shaly limestone impregnated with bituminous material. This type of ore is referred to as "unoxidized" or "black" ore but otherwise is similar to the "oxidized" ore. The gold in both types of ore is not free. It may be in colloidal form or in the form of some unidentified compound. There is no record of any sulfide minerals ever having been found in any of these ores (34). The gold in the oxidized ore was recovered easily by cyanidation, whereas the "unoxidized" or "black" ore required roasting to make it amenable to cyanidation. A red heat for 2-1/2 hours in the presence of abundant oxygen proved the ideal roast. The "black" ore averaged about 1.27 percent sulfur; after roasting, the sulfur content was 0.75 percent, of which 0.634 percent was water-soluble. Before roasting, the "black" ore weighed 87 pounds a cubic foot. The "oxidized" ore weighed 78 pounds (6).

The cyanide plant constructed in 1893 is reported to have been the first of its kind in the United States capable of treating 100 tons a day (5). The new plant, constructed in 1899, had a capacity of 150 tons a day (24). Later, the plant was increased to an ultimate capacity of 350 tons a day (31).

The ore was crushed to about 3/8-inch mesh and then leached in filter-bottom tanks. Weed (34) reports that in 1897 the grade of the ore averaged about \$10 a ton. Mining costs were \$1 a ton; hauling costs, by teams, \$0.50; and milling costs \$1.15. In later years, when the ore was mined less selectively and on a large scale, the grade of the ore decreased.

Production data for the years 1901 to 1912, inclusive, show that recoveries in gold ranged from \$0.70 to \$12 a ton (28). Production from the Gilt Edge properties from 1901 to 1912, exclusive of 1910, when 44,570 tons of ore was milled (metal recovered therefrom is not reported), was 377,957 tons, which yielded 64,480 ounces gold and more than 3,000 ounces silver (28). From 1913 to 1918 lessees mined a small tonnage of ore; they also cyanided 8,200 tons of tailings in 1918, from which 528 ounces gold and 74 ounces silver were recovered.

The ore was mined from several claims along the limestone-porphyry contact. Ore from open cuts and surface workings at first was transported to the old mill by horse-drawn wagons or over surface tramways. After the new mill was constructed nearer the mines, a main haulage adit was driven. This was connected by raises to other higher adits and drifts. Other development consisted of an inclined shaft 300 feet deep and a 200-foot winze sunk below the main haulage adit. Several shallow shafts were sunk. In 1902, the main haulage adit was reported to have been about 5,000 feet long, 2,000 feet of this being along the ore bodies (31). About 2-1/2 miles of underground developing was done prior to 1912 (30). Some of this work was done from the bottom of the winze, and large quantities of "black" ore are reported to have been found. Some of this "black" ore is claimed to have been higher in grade than the average oxidized ore, but its exploitation was not feasible because of the additional cost of roasting before treatment by cyanidation. The drag type of coal-fired roaster, formerly used for roasting the "black ore," is reported to have been inefficient and necessitated considerable expense for operation, maintenance, and repairs.

According to G. S. Abbott, Lewistown, Mont., it was estimated that at least \$1,500,000 worth of "black" ore remained in the lower levels of the Gilt Edge mines when operations were discontinued in 1912. Large quantities of low-grade oxidized ores still remain in some of the claims. The tailings from the old mills are reported to average about \$1.05 in gold and silver.

Whiskey Gulch (Au)

The Whiskey Gulch claims were located about 1884 or 1885. They are on the south side of a ridge south of Whiskey Gulch, about 2 miles southwest of the old town of Gilt Edge and about 10 miles northeast of Lewistown. The ore was transported from the mine over a surface tramway to a small mill on Whiskey Gulch. In 1899 a 100-ton cyanide plant was built by the Central Montana Mines Co. (2). Later the property was acquired by the Chicago Montana Mining Co. and subsequently by the Cave Gulch Mining Co. The mine and mill were abandoned about 1902. Some years later, W. G. Allen, Lewistown, Mont., the present owner, located two of the claims as the Red Rock and Gold Crop.

No official production data are available for the years before 1903. It is reported that production during 1903 and 1904 amounted to \$165,700 from ore averaging \$5.50 a ton (8). The ore deposits occur in altered silicified limestone at or near the contact of limestone and syenite porphyry. They are similar to those mined at the Gilt Edge mine. The gold in the ore mined was not free milling but could be recovered by cyanidation. None of the so-called "black ore" was mined.

Development on the claim now known as the Gold Crop claim consisted of a 25-foot shaft and two adits 70 feet and 20 feet long. Most of the ore was mined from the claim now known as the Red Rock claim. This claim was developed by about 2,000 feet of adits and drifts and about 500 feet of open cuts (30). The oxidized ore was comparatively soft; all mining was done by hand. According to Charles Edwards, Lewistown, Mont., large quantities of both oxidized and black ores still remain below the old workings.

McEvany or Big Six (Au)

The McEvany or Big Six group of claims is near the head of Ruby Gulch, about 2 miles southwest of Gilt Edge and about 10 miles northeast of Lewistown. About 1904 it was owned by the Chicago-Montana Mining Co., which also owned the nearby Whiskey Gulch mine. A 3,900-foot surface tramway was used for transporting the ore to the Whiskey Gulch mill. A considerable tonnage of ore was reported to have been blocked out (6). After being abandoned for many years, the claims were relocated about 1932 by Frank Hoagland and associates of Lewistown, Mont. A small cyanide plant was constructed. About 700 tons of ore was mined and milled. Mill heads averaged about \$4.50 in gold a ton, the tailings about \$0.20 a ton. Lack of sufficient water for the mill and high operating costs made the operation unprofitable; the mine was shut down and the equipment sold. The Big Six group is reported to be held by location by Wesley McEvany of Judith Gap, Mont. The ore bodies were similar to those at the Gilt Edge and Whiskey Gulch mines, consisting mainly of altered silicified limestone, which occurs along or near the contact of dikes or sills of syenite porphyry. According to W. G. Allen and Charles Edwards, Lewistown, Mont., large quantities of low-grade ore still remain.

Iron Chancellor (Pb-Zn)

The Iron Chancellor group, consisting of one patented and four unpatented claims, is on the south side of Manitoba Gulch, about 2 miles northwest of the old town of Gilt Edge and about 1 mile south of the Globe or Black Bull mine.

The Iron Chancellor claim was located in 1893; it was patented in 1899 by Thomas A. Turnblade. A half interest in the present group of claims was purchased in 1933 by Larry Shaver, Spokane, Wash. The remaining half interest was acquired by Shaver in 1940 from Harry Turnblade, son and heir of Thomas A. Turnblade. The property now is owned jointly by Larry Shaver and Bliss Moore, Spokane, Wash.

The ore is a complex mixture of galena, sphalerite, chalcOPYrite, iron pyrite, and their oxidation products. The ore occurs as a replacement along the west contact of a syenite porphyry dike with limestone and in a branch vein that trends outward from the contact into the limestone. According to Moore, the contact deposit is 3 to 4 feet wide where exposed in a drift 20 feet below the collar of the discovery shaft. The vein in limestone ranges from a few inches to 3 feet in width where exposed in the lower adit workings.

Development on the Iron Chancellor claim consists of a 90-foot discovery shaft with a 20-foot drift on the contact deposit and a lower 180-foot crosscut adit with a 60-foot drift and a 20-foot winze on the vein in limestone. A raise connects the lower adit to the shaft.

Records of production before 1935 are not available. In 1938, a small shipment of ore to the East Helena smelter assayed 2.6 ounces silver, 27.7 percent lead, 2.10 percent copper, and 31.2 percent zinc. Because of heavy zinc penalties and high transportation costs, the mine could not be operated profitably. An access road to the mine was constructed in 1940. No ore has been mined since that road was completed.

Three samples of the vein exposed in the winze from the lower adit were taken by Moore; they are reported to have assayed about 0.02 ounce gold, 2.7 ounces silver, 17.6 to 34.0 percent lead, 0.32 to 1.43 percent copper, and 25.5 to 30.5 percent zinc.

The Iron Chancellor group adjoins the Stand By claim of the Gilt Edge Mining Corp. at the north. Large quantities of low-grade ore have been mined from the Stand By claim from replacement deposits along the east side of a syenite porphyry dike. This dike extends into the Iron Chancellor group, where no developing has been done along its east contact.

Mammoth (Au)

The Mammoth mine is on the southeast side of Pekay Peak, about 2 miles north of the old town of Gilt Edge. Located in the early 1800's, little work was done on the property until about 1904, when a 60-ton cyanide plant was constructed. The mill operated a short time only (36). In 1919 the property was operated by the Judith Mountain Mining Co. About 250 feet of development work was done (15). The mill burned in 1922. At that time a reserve of 25,000 tons of ore was reported (18). The grade of the ore was reported to be about \$6 a ton (8). In 1948 the property was owned by James T. Littlejohn of Lewistown, Mont. The ore is similar to that at the Gilt Edge mines and consists mainly of silicified altered limestone that occurs along or near the contact of limestone and intrusive dikes or sills of syenite porphyry. The gold could not be recovered by amalgamation; it was recovered by cyanidation. Production data are not available.

The workings consist of adits, open cuts, and shallow shafts. No work was done below the zone of oxidation. Most of the workings were caved and inaccessible in 1943.

White Elephant (Au)

The White Elephant claim is a short distance north of the Gold Reef mine of the Gilt Edge Mining Corp. and about 1-3/4 miles northwest of Gilt Edge. It was located in the 1880's and some developing was done. In 1904, a 200-foot adit is reported to have been driven (36). The ore is similar in character to that in the Gilt Edge Mining Corp. claims. No work has been done on the claim in recent years. In 1948 the adit was caved.

Goodwin (Au)

The Goodwin group of claims is northeast of the old Mammoth mine and about 2 miles north of Gilt Edge. Little is known of its history. The group is now owned by William E. Wilson and William P. Ricketts, both of Gillette, Wyo.

According to Corry (5), long, vertically dipping veins containing auriferous limonite traverse Carboniferous limestone. The gangue minerals are quartz and calcite.

Ruby Gulch (Au)

The Ruby Gulch Mining Co. formerly operated on four claims in Ruby Gulch, about 12 miles northeast of Lewistown. The early history of the property is not known. In 1904 it was reported that 500 to 600 feet of development work had been done (36). A depth of about 100 feet below the surface was attained at the face of one of the adits, and at a point 125 feet in from the portal a 50-foot winze was sunk. One small pocket yielded ore assaying \$4,448 in gold a ton. Four tons of ore assaying about \$200 in gold a ton were sacked and shipped (36). Reported production for 1906 was 13 ounces gold, 980 ounces silver, and 99,241 pounds lead from 108 tons of ore (28). According to George E. Wiegler, Lewistown, Mont., this ore was mined from a chimney in limestone. No production has been reported since 1906. Present owners are not known.

Bay Horse (Ag)

The Bay Horse claim is near the head of Whiskey Gulch, about 2 miles southwest of Gilt Edge. Its early history is not known. At present it is owned by the Gilt Edge Mining Corp., Gilt Edge, Mont.

The property was operated by lessees from 1935 to 1937 and for a short time in 1939. Production during these years is reported to have been 6 ounces gold and 4,604 ounces silver from 149 tons of ore (28).

North Moccasin District

The North Moccasin district includes the areas covered by both the North Moccasin and the South Moccasin Mountains (fig. 1). Little underground mining has been done in the district for many years; consequently, information regarding the mines and prospects necessarily has been obtained largely from published references and from individuals familiar with their development and operation. Most of the old mine workings were caved and inaccessible when visited in 1948.

With the exception of a few scattered prospects, mining has been confined mainly to a belt along the eastern slope of the North Moccasin Mountains, near the old town of Kendall.

The ores in the Kendall area are similar in origin and occurrence to the ores near Gilt Edge. Mineralization along the contact of intrusive syenite porphyry and the sedimentary rocks, mainly limestone, was more intense over a longer distance than in the Gilt Edge area. Locally, the oxidized ore bodies were larger and extended to greater depths before the "black" or unoxidized ores were reached.

The North Moccasin district has produced the greater part of the gold and silver mined in Fergus County. From 1900 to 1922, operations at three of the larger properties in the district were virtually continuous, whereas in the other districts in the county, mining had become sporadic.

Production data for the district prior to 1932 are not available. Total production of gold, silver, lead, and zinc from 1900 to 1932 has been conservatively estimated to have been about 9 million dollars (1). Reported production for the district from 1932 to 1947, inclusive, is as follows: gold, 15,442.75 ounces valued at \$539,862; silver, 7,888 ounces valued at \$5,479; copper, 50 pounds valued at \$4 (28).

Placer-gold deposits in the North Moccasin district have been relatively unimportant. Placers were worked in some of the gulches on the west and north ends of the North Moccasin Mountains before the discovery of the lode mines near Kendall. Iron Gulch, McClure Gulch, Red Rock Creek, and Plum Creek have produced small amounts of placer gold intermittently for many years. These gulches have their source well back in the main intrusive mass of syenite porphyry (fig. 4). The gold-bearing gravels are limited in extent. The gold recovered is said to have been coarse; nuggets weighing as much as 4 ounces are reported to have been found in Iron Gulch. Total placer-gold production is unknown but has been estimated to have been not more than \$50,000 (1).

Small deposits of other metals have been found along or near contacts of sedimentary with intrusive igneous rocks in both the South and North Moccasin Mountains. These deposits, usually containing sulfide minerals or their oxidation products, are similar to deposits found in the Judith Mountains in the Warm Springs and Cone Butte districts.

The larger mines are at moderate altitudes; they are accessible during the greater part of the year over roads without steep grades.

Very little water is available at the mines for mining and milling purposes; it has to be brought to the mines through pipe lines from springs back in the higher mountains or from Warm Spring Creek, a stream flowing westward between the North Moccasin and South Moccasin Mountains about 4 miles south from Kendall. The water in Warm Spring Creek is increased in volume by a large warm spring that has a constant flow of 140 second-feet. The water from this spring formerly was used to develop about 500 kilowatts of electrical energy, which was utilized at the mines and mills near Kendall. Timber suitable for mine purposes was available within a few miles of the mines.

North Moccasin Mines Syndicate

The North Moccasin Mines Syndicate was formed in 1935 by J. H. McLean, George Wieglanda, Frank Bryant, and Tom Pittman. Leases on many of the claims in the Kendall area, then owned by the Barnes-King Development Co., were obtained from the trustees for that company. The old Spotted Horse cyanide mill and equipment were purchased and moved to a point near the Muleshoe open pit, about 1 mile north of the old town of Kendall. Ore from the pit first was hauled to the mill crusher by dump wagon. A bulldozer then was obtained, and the ore was pushed to the mill. Later, the ore was transported by trucks from loading ramps at several other open pits on the Kendall, North Moccasin, and Barnes-King claims. The ore was crushed to about 3/8 inch and leached by cyaniding in seven circular tanks. About 150 tons of ore a day was treated. Power for the mill was provided by Diesel engine. After the death of J. H. McLean, Mrs. McLean acquired the interests of the other partners. In 1940

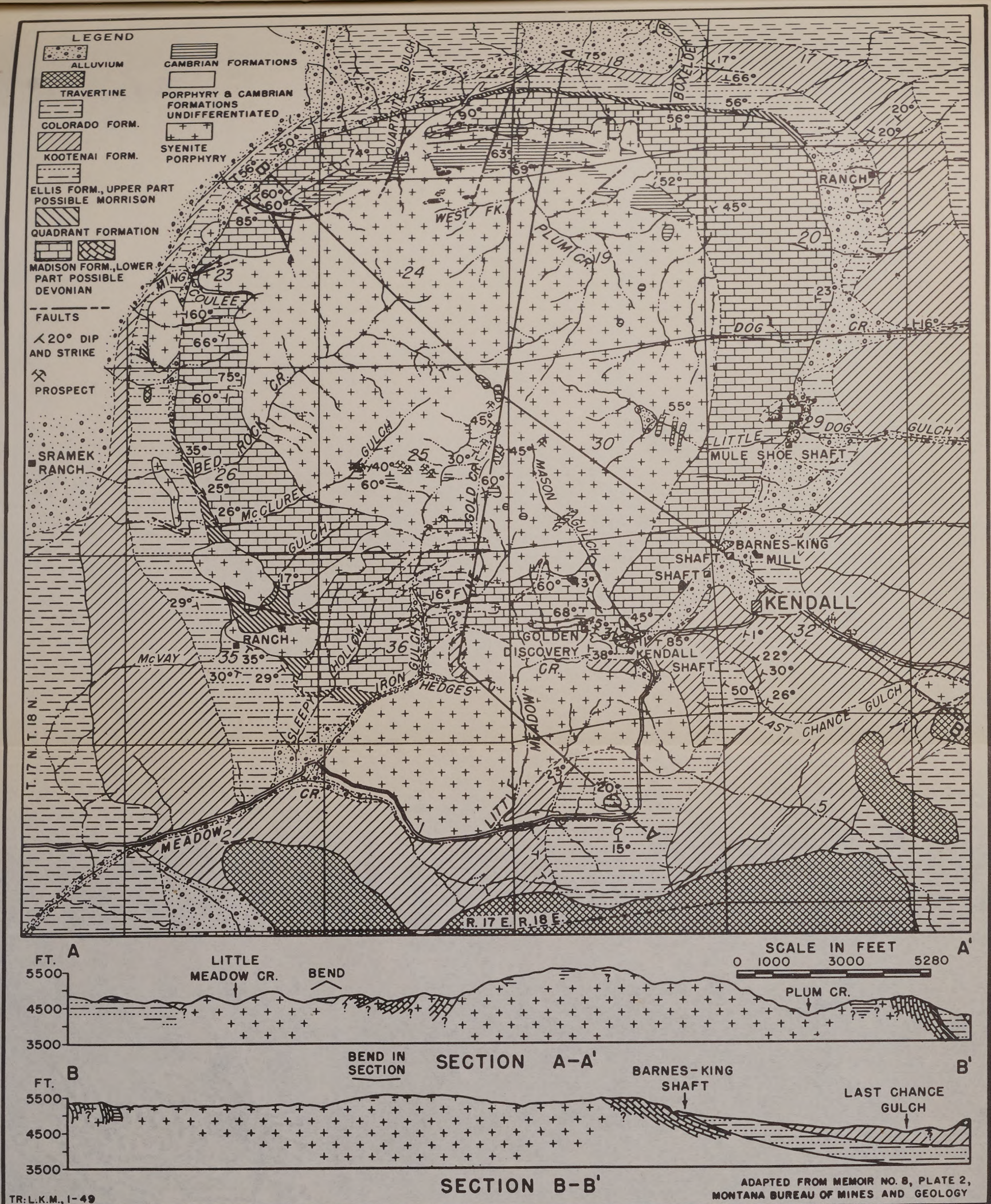


Figure 4. - Geologic map and sections of the North Moccasin Mountains, Fergus County, Mont.

she purchased all of the properties owned by the Barnes-King Development Co. These properties included the Barnes-King, Kendall, and North Moccasin mines. The North Moccasin Mines Syndicate (Mrs. Margharite McLean) now owns 71 patented claims, 1 unpatented claim, the Bullard ranch of 150 acres on Little Dog Creek, 3 mill sites, tailings-disposal rights, and water rights on Little Dog and Mason Creeks.

Operations of the North Moccasin Mines Syndicate were stopped in 1943 by Government Order L-208. Most of the equipment was sold. When visited in 1948, the mill building, assay office, shop, refinery, and several cabins remained in good condition. During the period 1936 to 1943, inclusive, reported production from all operations was 15,203 ounces gold and 7,238 ounces silver from 301,453 tons of ore (28). All ore mined was surface oxidized ore occurring at or near the contact of Madison limestone and syenite porphyry. Much of it was soft and could be mined easily by bulldozer. Some of it was in banded layers in the hard limestones and required blasting. The grade ranged from \$1 to \$7 a ton. Leaching of the coarsely crushed ore with a weak solution of cyanide recovered 85 to 90 percent of the gold and silver. No black ores were mined.

The properties now owned by the North Moccasin Syndicate extend for a distance of over 2 miles along the limestone-syenite porphyry contact. Many ore bodies still unexplored occur along the contact; most of them can be mined by surface methods. In addition, large quantities of oxidized and black ores remain in place below the shallow surface workings in many of the claims. Diamond drilling has indicated the presence of black ore at depth in some of the old mines.

Barnes-King (Au)

Gold was discovered on the Barnes-King property in 1893, 13 years after discovery in the Judith Mountains in the Warm Springs district. The claim on which the discovery was made was sold to John P. Barnes by the original locator on the basis of salted samples (36). Development, however, soon proved the presence of large ore bodies on the adjoining Passaic claim (36). By 1901 a 100-ton mill and cyanide plant had been constructed (2). In this same year the various interests were consolidated under the control of E. W. King as the Barnes-King Mining Co. The capacity of the mill was doubled in 1902. In 1905 the company owned 22 patented lode claims (31). The company was reorganized in 1907 by eastern capitalists and incorporated as the Barnes-King Development Co. This corporation acquired and operated the Barnes-King mine until July 1920, when all company operations ceased. Lessees operated the mine, mill, and power plant until 1923. In 1924 the mine and mill equipment was sold or otherwise disposed of (19). On December 16, the Barnes-King Development Co. was legally dissolved, and trustees were appointed to supervise the properties. About 1935 all of the Barnes-King properties, which included the Barnes-King, North Moccasin, and Kendall mines, were leased to the North Moccasin Mines Syndicate. In 1940 the Syndicate acquired ownership of the Barnes-King properties by purchase.

Production from the Barnes-King mines before 1907 is not of record. Blitz (1) states that 237,195 tons of ore yielding \$828,110 in gold bullion

was reported to have been mined between 1907 and 1910. From 1911 to 1922, inclusive, it is reported that bullion valued at \$2,167,313 was sold by the Barnes-King Development Co. (18) (see North Moccasin mine). Reported production from the Passaic, Muleshoe, and Horseshoe claims from 1901 to 1910, inclusive is 125,145 ounces gold and 15,168 ounces silver from 506,006 tons of ore (28).

The ore bodies mined were mainly in limestone near the top of the Madison formation in the vicinity of a large intrusive mass of syenite porphyry, usually along argillaceous beds some distance from the contact. In some places the ore was found at the contacts of sedimentary rocks with sills or dikes extending away from the main mass of porphyry. Ore was found also in brecciated bands in limestone. The ore bodies were tabular in form, fairly uniform in thickness, and elongated in a direction oblique to the contact. The mining width ranged from 10 to 15 feet. The dip of the ore bodies near the outcrop ranged from 20° to 60° but flattened at depth in accordance with the attitude of the sedimentary formations (figs. 5 and 5A).

As at Gilt Edge, the gold in the ores was not free milling. It was finely disseminated through the altered, decomposed limestone, probably colloidal in form, or in the form of some unidentified compound. No sulfide minerals have been found in any of the ores. The oxidized ore could be treated readily by cyanidation. Below the zone of oxidation, unoxidized or "black" ores were found in bituminous shaly bands. These black ores required roasting before the gold could be recovered by cyanidation. An oil-fired rotary roaster was used for this purpose. The ore was crushed by rolls set at 3/8 inch and cyanided without sizing. Gold extraction is reported to have been about 90 percent. More than 1 million tons of tailings from the cyanide plant, which also treated the ores from the North Moccasin mine, are impounded. These tailings are reported to contain an average of \$1.10 in gold a ton.

Ore was mined first from open pits and near surface adits. By 1905 an inclined shaft had been sunk in the main ore body. Later, a 280-foot vertical shaft was sunk in the hanging wall (31). An adit about 3,700 feet long was driven on the 200-foot shaft level to the Horseshoe and Muleshoe claims, about 1 mile north of the town of Kendall and near the mouth of Little Dog Canyon (32). The lower levels were developed through a series of winzes sunk from the lowest shaft level. Several thousand feet of additional development work was done on the original Barnes-King claims and on the adjoining North Moccasin Gold Mining Co.'s property after its purchase by the Barnes-King Development Co. in 1912.

The lower levels of the North Moccasin mine were partly developed from the 400-foot level of the Barnes-King mine as the ore shoots on the Barnes-King-Passaic claim pitched into the North Moccasin property. According to the annual report of the Barnes-King Development Co. for the year ended December 31, 1916, the 600-foot level of the North Moccasin mine was driven 1,000 feet on the vein toward the Kendall mine, but no milling ore was developed. The main ore shoot on the Barnes-King claims was mined above the 300-foot level and through winzes from that level. The same ore shoot on the North Moccasin claims was mined to the 740-foot level.

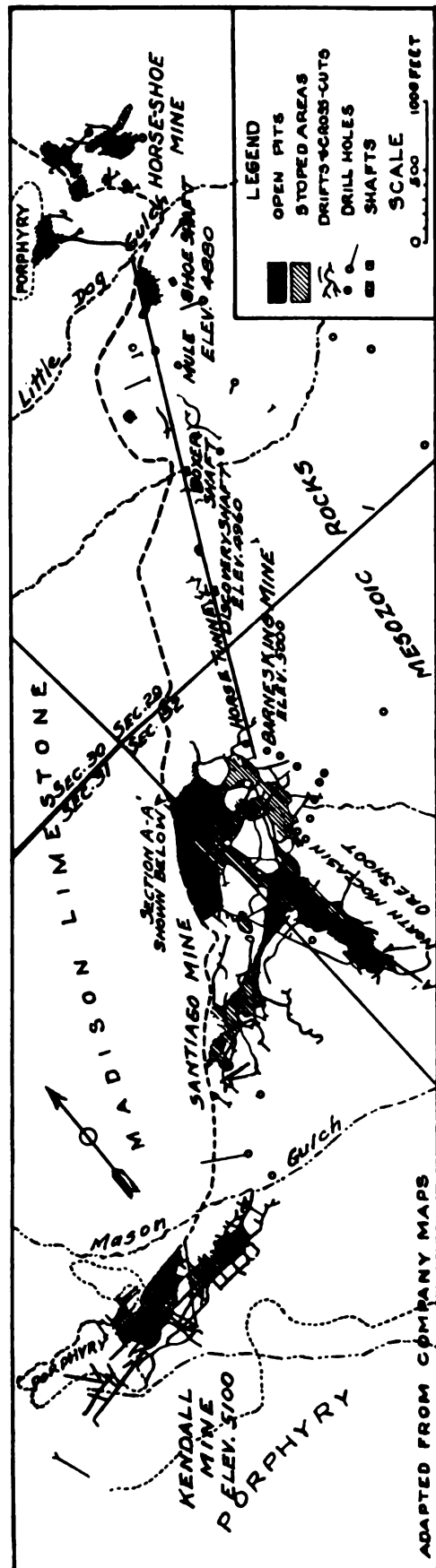


Figure 5. - Surface plans and mine workings, North Moccasin district, Fergus County, Mont.

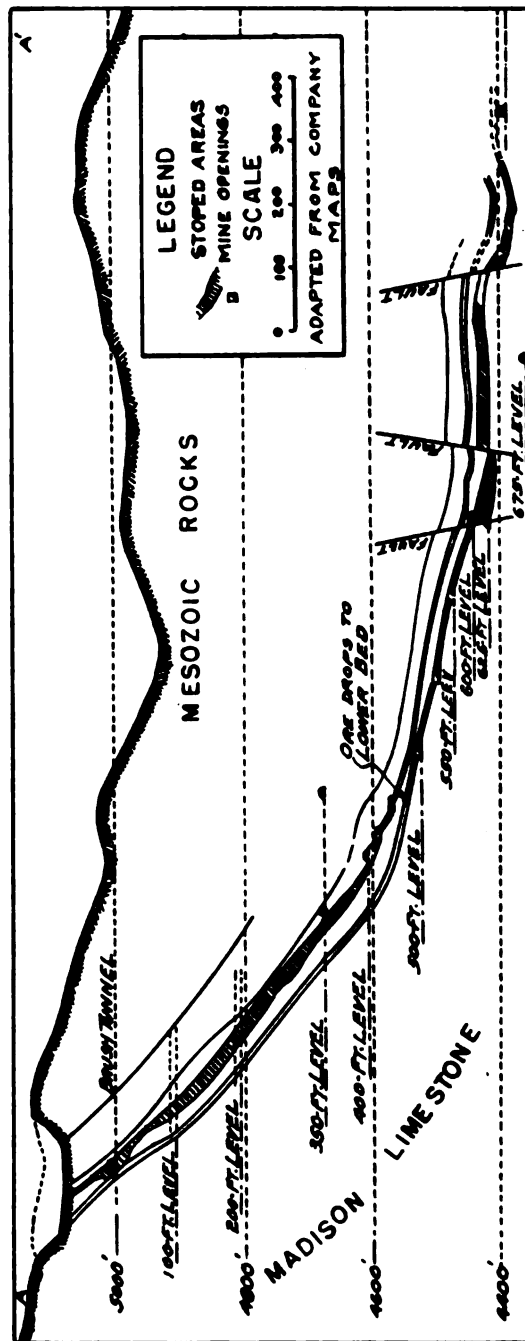


Figure 5A. - Cross section A-A' through North Moccasin ore shoot.

The Kendall Gold Mining Co. holdings, including the Warm Spring Creek power plant, were purchased in 1912. The Kendall mine never was worked by the Barnes-King Development Co. after it was acquired, although lessees produced a considerable tonnage of ore from workings above the 100-foot level and from the open pit (15).

When visited in 1948, all of the old underground mine workings were inaccessible.

North Moccasin (Au)

The North Moccasin group of six claims adjoins the Barnes-King group on the west. Ore was first discovered on the claims in 1898. By 1906 a shaft had been sunk to a depth of 325 feet, and considerable development work was done (31) (37). In 1908 the claims were sold to the North Moccasin Gold Mining Co. Work stopped in 1909, but the mine was reopened the latter part of 1910, and several hundred feet of development work was done (32). The property was purchased for \$150,000 in 1912 by the Barnes-King Development Co. and operated from the 400-foot level of the Barnes-King mine (33). The old North Moccasin shaft was repaired and reopened in 1913. In 1914, ore was hoisted from three levels. Operations were continuous until July 1920, when the Barnes-King Development Co. suspended operations. In August 1920 the mine was turned over to lessees (16). All workings below the 500-foot level were stripped of pipe and rails and abandoned in 1921 (17). In 1922, when leasing operations ceased, all ore of \$3 grade or better was reported to have been exhausted (5).

Total production from the North Moccasin group from 1908 to 1922, inclusive, is reported to have been 116,835 ounces gold and 18,485 ounces silver from 321,232 tons of ore (28). Most of the \$2,167,313 in bullion sold by the Barnes-King Development Co. between 1911 and 1922 was obtained from ore mined from the North Moccasin mine.

The North Moccasin properties were leased to the North Moccasin Mines Syndicate about 1935 by the trustees for the Barnes-King Development Co. In 1940, the North Moccasin Mines Syndicate acquired all of the North Moccasin claims by purchase.

The ore bodies were similar to those at the adjoining Barnes-King and Kendall mines, being mainly of altered limestone or as mineralized bands in the bituminous shaly limestone at depth. None of the ore was free-milling. The oxidized ores could be treated readily by cyanidation, but the unoxidized or "black" ore required roasting before it would respond to cyanide treatment. All ores were treated in the Barnes-King mill, where they were crushed to about 3/8 inch and cyanided without sizing. In 1915, 47,038 tons of ore averaging \$9.80 a ton in gold and silver was milled. Extraction was 89.7 percent. Cyanide consumption was 0.4 pound per ton of ore, zinc 0.43 pound, and lime 4.03 pounds. An extraction of 81.3 percent was made from the roasted black ores, for which 21.5 pounds of lime and 1.3 pounds of cyanide per ton of ore were required (12).

In 1948 the shafts were caved and the underground workings were inaccessible.

Kendall (Au)

The ore deposit, later to become the Kendall mine, was discovered and located by Charles D. Allen, who sold it to Harry T. Kendall. An 80-ton cyanide plant was built in 1900 (36). About 6 months after the mill was completed, the property was sold for \$400,000 to the Kendall Gold Mining Co., controlled by Finch and Campbell of Spokane, Wash. This company constructed a new 350-ton mill and built the 600-horsepower Warm Spring Creek hydroelectric power plant (33).

The property was operated continuously until 1912, when it was taken over by the Barnes-King Development Co. Operations by this company were discontinued in 1913, although lessees operated the mine and mill until 1922. In 1935 the Kendall property was leased to the North Moccasin Mines Syndicate. The Syndicate purchased the properties in 1940.

No production data are available for the operations conducted by Harry Kendall. Reported production from 1902 to 1913, when operated by the Kendall Gold Mining Co., is 188,543 ounces gold and 5,142 ounces silver from 733,237 tons of ore. Between 1915 and 1922, production is reported to have been 6,501 ounces gold and 580 ounces silver from 34,649 tons of ore (28); most of this ore was mined by lessees from above the 100-foot level and from the open pit.

The ore body in the Kendall mine was the largest in the North Moccasin district. It occurred in limestone at or near the contact of Madison limestone and a highly altered intrusive dike or sill of syenite porphyry. On the surface, the mineralized zone is reported to have been 700 feet long and 100 feet wide (33). On the 100-foot level the ore zone was 100 to 115 feet wide; it was 160 feet wide on the 200-foot level (36). The dip of the ore body on the 200-foot level is reported to have been about 65° S. (37).

The mine was worked first through an inclined shaft sunk in the ore body. About 1905 or 1906, a 600-foot vertical shaft was sunk and a 150-horsepower, double-drum electric hoist was installed. A large open pit was developed subsequently by glory-holing from the underground workings. A 75-horsepower motor was used to drive the 8-drill compressor. The ore was mined in the underground workings by square-set methods, hoisted to a surface bin, and then trammed to the mill (31). After being crushed to about 3/8 inch, it was leached in tanks 22 feet square and 8-1/2 feet deep. The tanks each had a capacity of 170 dry tons of ore. Leaching for 7 days with a solution containing 3 pounds of cyanide a ton, followed by a 1-pound solution, gave an extraction of about 87 percent. The mill heads averaged about \$6.50 in gold a ton (35) (37). In 1910 it was reported that an average of \$5.75 in gold a ton had been obtained from 639,972 tons of ore. The cost of mining and milling this ore was \$1.642 a ton; total cost was \$2.622 a ton (35). About 800,000 tons of tailings from the cyanide plant are impounded. According to Mrs. M. F. McLean, Lewistown, Mont., these tailings contain an average of \$1.05 in gold a ton.

At the time the mine was sold to the Barnes-King Development Co., the ore was exhausted to a depth of 560 feet, or 180 feet above the lowest level of the adjoining North Moccasin mine (12). The Kendall mill was not equipped with a roaster, and only oxidized ores were mined. According to Mrs. M. F. McLean, large quantities of black ore were developed below the 300-foot level but never were mined. It is known that a very large tonnage of oxidized ore was lost when one of the large square-set stopes collapsed.

Except for a part of the large open pit, or glory hole, and some short adits, the mine workings were inaccessible in 1948.

Lead Chief (Parrent) (Pb-Zn)

The Lead Chief-Parrent mine is near the top of the main ridge on the northeast side of the South Moccasin Mountains about 5 miles southwest of Brooks. The property was first located by Hook and Holiday. Henry Parrent and son operated the mine intermittently for a number of years and then abandoned it. The last work done on the claims was in December 1939. No production records are available. In July 1947 the claims were located by H. W. Clark, Lewistown, Mont., as the Lead Chief and Lead Chief No. 2. According to Clark, early shipments of ore to the smelter were unprofitable because of its zinc content.

The ore is a complex mixture of galena, sphalerite, chalcopyrite, iron pyrite, and their oxidation products. The ore body occurs as a small, elongated replacement in shaly thin-bedded limestones, which have been lifted by a laccolithic intrusion of syenite porphyry. The deposit, where opened by the discovery shaft, was about 25 feet long and ranged from 4 to 6 inches wide at the ends to about 4 feet at the center. The strike is north; the dip is 12° to 20° E.

An adit was driven through limestone to the ore shoot a short distance below its outcrop. Ore, similar to that on the dump of the discovery shaft, is found on this adit dump. About 150 feet farther down the ridge another adit was driven about 10 feet into unaltered syenite porphyry. About 300 feet north of the upper adit and about 150 feet lower in altitude, a third adit was driven. This adit, about 103 feet long, was entirely in syenite porphyry, which was highly altered and kaolinized near the adit face. No lead or zinc minerals were in evidence in any of the adits driven into the porphyry. A Bureau of Mines sample of some of the best ore found on the dump at the discovery shaft assayed 7.3 percent lead, 24.0 percent zinc, 0.01 ounce gold, and 6.17 ounces silver.

When visited in 1948, the upper adit and the discovery shaft were caved. The lower adit was in good condition.

Parsons (Pb-Zn)

The Parsons prospect is in McClure Gulch, about 3-1/2 miles by trail northwest of the Kendall mine. It was located in the early 1880's by McClure, a California placer miner. Mrs. James Connolly inherited the claim after McClure's death. James Connolly and his heirs carried on with the development.

of the claim, which later was abandoned. It was relocated after many years as the Montida claim by Clifford R. Parsons. In May 1948 it was acquired by Mrs. Margharite F. McLean of Lewistown, Mont. No records of any production are available.

According to Parsons, a small quartz vein, extending into the syenite porphyry from the contact with an overlying remnant of shaly Cambrian limestone, is said to have yielded some gold. This vein also contains fine-grained galena, sphalerite, and pyrite. In a crosscut adit driven to cut the vein about 25 feet below the outcrop, a 6-foot zone of soft kaolinized material, or altered dike, was encountered, along which a drift was driven eastward for about 80 feet. A winze was sunk to a depth of 20 feet in the kaolinized zone, which contains scattered large crystals of galena, sphalerite, and iron pyrite as well as small, clear crystals said to be topaz. According to R. S. Hamilton, Lewistown, Mont., some of these crystals are reported to have been sent east for cutting and later were sold locally by Connolly. According to Parsons, further sinking of the winze was prevented by a heavy flow of water. The mine workings now are inaccessible.

Republic (Hamilton Lead) (Pb-Zn)

The Republic mine, also known as the Hamilton Lead mine, is about 1-1/2 miles northeast of Hanover, in the foothills on the south side of the South Moccasin Mountains. The claim was located in 1891. About 1902 the claim was acquired by R. S. Hamilton, Route 3, Lewistown, Mont., who patented it in 1907. No production data are available.

The ore body occurs as a brecciated syenite porphyry chimney or pipe in thin-bedded shales. The chimney is about 100 feet in diameter. The ore occurs mainly along the north side of the chimney in an ore shoot about 2 feet wide. The ore consisted of galena, sphalerite, and some iron pyrite. These minerals also occur as scattered masses and disseminations elsewhere in the chimney.

A discovery shaft was sunk on the 2-foot ore body to a depth of 45 feet. A 2-compartment shaft, about 40 feet south of the discovery shaft, was sunk to a depth of 100 feet. A crosscut at the 40-foot level connects the two shafts. Another crosscut was driven northerly on the 95-foot level, but the main ore shoot was not reached.

Two cars of ore were shipped to a smelter, but zinc penalties made these shipments unprofitable. Several samples sent to different smelting companies are reported by Hamilton to have assayed 37.5 to 40.2 percent zinc, 10.0 to 21.0 percent lead, 3.9 to 5.7 ounces silver, about 0.01 ounce gold, 3 to 6 percent iron, and 0.20 to 0.27 percent copper, with traces of cadmium. The brecciated material, other than that in the main ore shoot, is reported to have assayed 0.5 to 1.5 percent zinc, 0.5 to 1.5 percent lead, \$0.17 to \$0.70 silver, about \$1.00 in gold, and 2 to 7 percent iron.

A Bureau of Mines sample of ore picked from the dump of the discovery shaft in 1948 assayed 23.8 percent zinc, 2.1 percent lead, 0.92 ounce silver, a trace of gold, and 0.9 percent copper. Two Bureau of Mines samples taken in 1942 of decomposed dump material at the main shaft assayed 0.1 percent lead, 0.55 percent zinc, 0.2 percent lead, and 0.20 percent zinc, respectively.

When visited in 1948, the shafts were caved or covered; the mine workings were inaccessible.

Abby (Au)

The Abby mine is about 2 miles north of the old town of Kendall on the east side of the North Moccasin Mountains. The property was located in the early days, and considerable development work was done before 1910 (32). Further work was done in 1911 and 1914 (7) (10). Over \$90,000 is reported to have been spent in development, which consisted mainly of a 200-foot shaft, a 600-foot adit, and several hundred feet of drifting. A raise was driven to the surface to provide another exit and for ventilation (32). Some low-grade gold ore was developed, but no extensive ore bodies were found (10). No ore was milled or shipped. The mine has been idle for many years. In 1948 the shaft was inaccessible. The Abby property, consisting of the Abby, Abby Extension, and Keno claims, is owned by Joe Montgomery and Jack Priscoe, Lewistown, Mont. (one-half); Edith Kelly, 520 South Wyoming St., Butte, Mont. (one-fourth); Shirley Bigelow, Annabelle Wilson DeRosier, and Montana Wilson, Snoqualmie, Wash. (one-fourth).

Blue Bell (Pb, Ag)

The Blue Bell claim is near the mouth of McClure Gulch on the southwest side of the North Moccasin Mountains. It is about 3-1/4 miles northwest of the old town of Kendall. Nothing is known of its early history. It now is owned by Olive Helsing and E. A. Foster, c/o Mildred Runsvold, 3009 First Ave. N., Great Falls, Mont. According to E. C. Parsons, Lewistown, Mont., the ore body is a replacement deposit in thick-bedded limestone near a syenite porphyry contact. The ore mined was a complex mixture of galena, sphalerite, pyrite, and chalcopyrite. One 16-ton shipment of ore in 1916 is reported to have contained 7 ounces gold, 193 ounces silver, 788 pounds copper, and 9,979 pounds lead (28).

Golden Discovery (Au)

The Golden Discovery claim is about one-half mile west of the Kendall mine. Some work was done in 1909 by the Golden Discovery Gold Mining Co., but the claim was idle in 1910. Additional development work was done in 1911 (32). Nothing has been done since. The claim is owned now by Mrs. Margharite F. McLean, Lewistown, Mont.

Development work consisted mainly of a 2-compartment shaft 500 feet deep, and a 350-foot crosscut was driven north on the 300-foot level. Some good ore was found, but no large commercial ore bodies were developed (7) (10).

H and H (Au)

The H and H claim was about 1,500 feet west of the Kendall mine. In 1904 it was reported a 500-foot adit had been driven and that oxidized ore containing

\$4 to \$16 a ton in gold was being developed (36). This claim may have been patented later under another name. No other information is available.

Hazzard Group (Au)

The Hazzard group of claims is about 1 mile west of the Kendall mine near the mouth of Iron Gulch. The claims are owned by Glenn D. Trader, 105 W. Cutler Ave., Helena, Mont. The old workings now are inaccessible.

Vulcan and Erie (Au, Ag)

The Vulcan and Erie claims are in Iron Gulch about 1-3/4 miles west of the Kendall mine. In 1948 they were owned by Julius Goettel and Fred Anderson, both of Lewistown, Mont. The extent of the development work or the character of the ore bodies is not known. The old mine workings now are inaccessible.

Cone Butte District

The Cone Butte district comprises all of the northeastern part of the Judith Mountains extending from Judith Peak to Black Butte, the most easterly of the peaks in the range (fig. 1). The mountains are of laccolithic intrusive rocks. Sedimentary rocks ranging from Cambrian to Cretaceous were uplifted by intrusive syenite porphyry. Erosion has exposed the syenite porphyry irregularly throughout the area. Remnants of sedimentary rocks have been left as islands or blocks resting on the intrusive mass (fig. 3).

Mineral-bearing solutions, which accompanied or followed the igneous activity, circulated through cracks and fissures in both the igneous and sedimentary rocks. Three types of ore deposits are found widely scattered throughout the district. They occur along the contact of syenite porphyry and sedimentary rocks, as replacements in limestone, and as replacements along fissures in syenite porphyry. Most of the deposits are small.

Production records before 1932 are not available for the Cone Butte district. Reported production of gold, silver, lead, and copper from 1932 to 1947, inclusive, amounted to only \$17,691. This is divided as follows: 393.35 ounces gold valued at \$13,864; 3,994 ounces silver valued at \$2,792; 5,563 pounds lead valued at \$279; and 5,694 pounds copper valued at \$756 (28). Some zinc is known to have been contained in the ores marketed, but no zinc production has been reported, probably because it was not credited in smelter settlements.

Some small-scale placer mining was done on West Armells Creek and on Ford Creek in the early days. Results of these operations are not known; no production data are available.

Roads in the district generally are unimproved and can be traveled only during the summer and early fall months. Timber for mining purposes usually is available near the mines. Water from springs at higher elevations is sufficient for small milling operations during most of the year.

Cave (Pb-Ag)

The Cave mine is on a ridge along the east side of West Armells Creek, about 8-1/2 miles southeast of Hilger or about 26 miles northeast of Lewistown.

The claim was located about 1882 or 1883 by the Gies brothers. The main ore body eventually was developed about 1,000 feet away from the original discovery (36). The mine was operated by the Gies brothers until about 1887, when the ore body was said to have been exhausted (34). The ore was hauled in wagons to a small smelter near Maiden. About 400 wagon loads, or 800 to 1,000 tons of ore having a gross value of about \$50 a ton, are said to have been mined and shipped (36). No other production records are available.

The ore body occurred as a replacement in limestone distant from the underlying syenite porphyry. It was a long, narrow deposit, except for local widenings along cross fractures. The average width was about 4 feet. The deposit was mined for a length of about 300 feet. The strike ranged from N. 10° to 50° W. The dip was nearly vertical. Galena was the principal metallic mineral. Except where exposed by erosion in a ravine, the ore body did not outcrop.

The deposit was mined through an adit that intersected the ore body near its upper limits and through another adit about 75 feet lower in altitude. In 1948 the upper adit was open and in good condition; the top of the old stope was open for a length of about 275 feet. The lower adit and several open cuts were caved.

Golden Armells and Armells Bonanza (Au)

The Golden Armells and the Armells Bonanza claims are on the east side of the East Fork of Armells Creek, about 9 miles east of Hilger. They were located first in the 1880's. R. N. Winston located them some years later. G. C. Darrah and J. R. Patten subsequently located them. The claims now are owned by the Golden Armells Mining Co., of which J. C. Darrah, George C. Darrah, and J. R. Patten, all of Lewistown, Mont., are the principal owners.

The Golden Armells claim is on the north slope of a ridge extending westward from Elk Peak. The ridge is composed mainly of syenite porphyry, from which most of the overlying thin-bedded limestone has been eroded. Oxidized gold ore occurs in a narrow fissure vein in the porphyry near the limestone-porphyry contact. The vein strikes N. 65° W. and dips about 70° SW. The vein was developed by a 50-foot shaft, from the bottom of which a drift was driven southeast for about 50 feet. A 90-foot adit was driven later to connect with the bottom of the shaft; an 80-foot adit drift also was driven southeast from near the shaft collar. Ore mined came from one short ore shoot, which was stoped to the surface from the 50-foot shaft level. This ore shoot was 20 feet long at the shaft level and about 40 feet long at the surface.

Three small lots of ore were shipped. Data on these shipments are as follows:

Date of shipment	Shipment weight, pounds	Ounces		Percent				Assays by:
		Gold	Silver	Copper	Arsenic	Antimony	Moisture	
8/20/36.	8,800	0.96	1.8	0.01	0.18	0.01	0.9	East Helena smelter.
8/24/37.	30,660	.73	0.7	.01	.12	.01	2.1	East Helena smelter.
7/26/39.	44,040	.78	3.4	-	-	-	2.1	Washoe sampler.

When visited in 1948, the lower adit and shaft were caved and inaccessible. The 80-foot adit drift was in fair condition.

The Armells Bonanza claim adjoins the Golden Armells claim on the northeast. Gold-bearing ore occurs as a replacement deposit at the contact of syenite porphyry and overlying limestone. This deposit has been developed by an open pit about 50 feet long and by two crosscut adits, 20 feet and 137 feet long, driven to the contact through unaltered porphyry. Another deposit on the claim occurs along a phonolite porphyry dike that cuts the syenite porphyry. The ore minerals are mainly galena and sphalerite disseminated sparsely in the altered porphyry. A cut about 30 feet long was opened in this deposit. No ore has been shipped from the claim.

According to George C. Darrah, a sample cut across 4 feet of the ore at the east end of the open-cut assayed 0.46 ounce gold, 2.4 ounces silver, 82.4 percent silica, 2.2 percent iron, and 5.4 percent aluminum oxide. Assays of other samples from the west end of the pit ranged from \$5.60 to \$21 in gold and silver a ton.

When visited in 1948, the pits had sloughed in and the adits were caved.

Armells Producer (Pb, Zn)

The Armells Producer claim is about half a mile south of the Golden Armells claim and near the top of the main ridge north of the East Fork of Fords Creek. The claim is held by location by the Golden Armells Mining Co., Lewistown, Mont. A narrow replacement deposit occurs in limestone a short distance from a limestone-syenite porphyry contact. The length of the deposit is unknown. It strikes north; the dip is about 45° west. The ore minerals are galena and sphalerite and their oxidation products. Two inclined shafts have been sunk. One of these shafts, sunk many years ago, is reported to have been 60 feet deep. According to George C. Darrah, Lewistown, Mont., 2 carloads of lead-silver ore was mined from this shaft and shipped.

The second inclined shaft was sunk in 1937 about 35 feet north of the first shaft. It was stopped at a depth of 50 feet, where it broke through into an old stope. During sinking, 3.47 tons of ore was recovered. This ore was shipped to the smelter at East Helena; it is reported to have assayed 0.35 ounce gold and 4.2 ounces silver a ton, 28.5 percent lead, 0.10 percent copper, 11.5 percent zinc, 2.0 percent sulfur, 0.08 percent arsenic, and 0.09 percent antimony. Moisture content was 10.6 percent. Net smelter value was \$26.86 a ton. After deductions for smelting, zinc penalties, freight, moisture, and sampling, net proceeds were \$11.86 a ton, or \$39.51 for the shipment. Both shafts now are caved.

High Hope (Pb, Zn)

The High Hope claim is in the saddle between the two high peaks of Elk Mountain, about 1 mile east of the Golden Armells claim. It is owned by the Golden Armells Mining Co.

A 15-foot shaft has been sunk near the top of the ridge on a replacement vein along the north contact of a syenite porphyry dike that cuts thin-bedded limestone. Most of the galena and sphalerite in the vein exposed in this shaft is confined to a width of about 8 inches in a gangue mainly of quartz and calcite. Alteration and silicification with some scattered galena and sphalerite, however, extend 1 to 2 feet into both walls.

About 400 feet west of this shaft and about 150 feet lower in altitude, a 20-foot adit has been driven in the dike. Small amounts of disseminated galena and sphalerite are in evidence in some of the altered porphyry exposed in this adit. The contact was not reached. No work has been done along the contact in this vicinity.

The claim has not been productive. The shaft and adit remain accessible.

Old Glory (Bliss) (Au, Ag)

The Old Glory group of five unpatented claims is on the northeast side of Elk Peak near the upper end of Mitchell Canyon, about 8 miles southwest of Fergus. Ore first was discovered on the property in the early 1880's and was mined intermittently for many years. The mine was operated for some time by the Bliss Mining Co. and later by Oz Lehman of Lewistown, Mont. A small cyanide plant was constructed in 1935. At about this time, ownership of the property was acquired by Leonard Olson of Chicago, Ill. Olson operated the mine and mill until 1938, when operations ceased. Lessees worked the mine in 1940 and 1941; since then it has been idle. The mine was developed by a 100-foot shaft, a 200-foot adit, and a 50-foot open cut (30). All shafts are inaccessible now. The main adit remains open. No production data for the years before 1901 are available. Production from 1901 to 1941, inclusive, is reported to have been 219 ounces gold and 2,086 ounces silver and 418 tons of ore (28).

The ore occurred in replacement deposits in limestone at or near a syenite porphyry contact, also in lense-shaped replacements along narrow fractures in altered porphyry. The ore minerals were free gold, tellurides, and sulfides in a gangue of a fine-grained purple fluorite, quartz, and calcite. Gold and silver minerals also occur in small limonite-filled seams in the limestone.

A shallow shaft also was sunk in another deposit in limestone near the syenite porphyry contact. This deposit contains galena, sphalerite, pyrite, and their oxidation products. According to Charles Kirby, Lewistown, Mont., a small amount of lead-silver ore was mined from this deposit.

Voltaire (Old Hanson) (Au-Ag)

The Voltaire or Old Hanson mine is at the upper headwaters of the East Fork of Armells Creek, about 3-3/4 miles northwest of old Fort Maginnis and about three-fourths mile west of the Gies mine. The claim was located about 1886 by Sten Hanson and Andrew Fergus. A mill using Huntington mills and vanners was built. Some concentrates were shipped to Wales via Fort Benton. Later, a small cyanide plant was constructed, but it was not operated successfully (34). The W. A. Clark interests at one time offered \$30,000 for the

property but the offer was not accepted. No mining has been done for many years. The property, consisting of one patented claim, now is owned by R. S. Hamilton, Lewistown, Route 3, Mont., and Mrs. Bertha U. Phelan, 413 Montana Street, Lewistown, Mont. No production data are available.

The ore deposit occurs along the contact of a phonolite porphyry dike and Benton shales. The altered silicified porphyry has a dark-blue color; it contains cracks and small seams filled with auriferous pyrite and possibly some tellurides (34). According to Hamilton, the deposit averages about 6 feet in width and \$3 to \$6 in gold a ton.

The deposit has been developed by a 90-foot shaft, a 50-foot adit crosscut, and about 300 feet of drifts. The ore in the shaft bottom is reported to have assayed as much as \$200 a ton across a width of 21 inches. A heavy flow of water stopped the shaft sinking in 1891. An attempt to sink another shaft about 1,000 feet south of the first shaft failed when gas was encountered in the shale formation. Carbonaceous or bituminous material in the ore is believed to have been responsible, in part, for the unsuccessful operation of the cyanide plant. The mine workings are now inaccessible.

Gies (Au-Ag)

The Gies property consists of two groups of claims. The Bertha group of six patented claims is on the east side of the divide between the headwaters of the East Fork of Armells Creek and the East Fork of Ford Creek, about 3 miles northwest of old Fort Maginnis. The Red Metal group of five patented claims is about half a mile east of the Bertha group.

Both groups were located in the early 1880's by Vincent Gies; they were patented later by Gies and his brother. Most of the development work on the Bertha group was done by the Cone Butte Mining Co. (32), which purchased the mine from Gies and operated it during 1909 and 1910. This company failed, and Gies recovered the property. The Bertha group of claims now is owned by Florian J. Gies of Monarch, Mont. The Red Metal group is owned by A. V. Gies of Lewistown, Mont.

On the Bertha group, the ore occurs in replacement deposits along or near the contact of limestone and syenite porphyry. Several small oxidized deposits occur in the limestone. The ore bodies in the porphyry are in the form of hard, siliceous lenses, which contain small amounts of disseminated pyrite and chalcopyrite. These lenses have a westerly to northwesterly strike and dip nearly vertical. Galena and sphalerite, with their oxidation products, occur in a narrow deposit along another limestone-porphry contact that strikes southwestward and dips nearly vertical. It has been drifted on for about 300 feet.

Several thousand feet of developing has been done, mostly by and from a main adit.

No production data for the years before 1935 are available. During 1935, 7 ounces gold, 18 ounces silver, and 239 pounds lead are reported to have been recovered from 7 tons of ore (28).

According to Charles Edwards, Lewistown, Mont., one small shoot of ore about 80 feet in from the portal of the main adit yielded 20 tons of ore that assayed \$8 in gold a ton. Weed reported that ore assaying up to \$80 in gold a ton had been mined, and that 1 ton of ore had been shipped to the smelter at Great Falls (34). In 1948 the main adit on the Bertha group was open and in fair condition, although small caves had closed some of the workings.

The ore on the Red Metal claim is reported to occur along a limestone-syenite porphyry contact. According to Edwards, some rich silver ore was mined from a replacement deposit consisting mainly of galena with small amounts of sphalerite and pyrite. No production data are available. The old workings now are inaccessible.

Greshchuk (Murphy) Claims (Au, Pb-Ag)

The Greshchuk claims consist of two groups, the Golden Eagle group of five claims and the North or Accident group of four claims. The Golden Eagle group is on the East Fork of Ford Creek, about 3-1/2 miles northwest of old Fort Maginnis. The North or Accident group is about half a mile north of the Golden Eagle on the southwest slope of Elk Peak. Both groups were located in the early 1880's by James and Dennis Murphy, who later patented them (34). They were abandoned some time after 1914, after they had been worked intermittently by various lessees. The present owner, William Greshchuk, Route 3, Lewistown, Mont., bought the claims at tax sale from Fergus County, but extensive litigation with the administrator of the Murphy estate developed before a clear title was obtained.

A 10-stamp mill was built on the Golden Eagle group about 1892; it was operated for only a short time. Later, a small cyanide plant was constructed (32). According to Charles Edwards, Lewistown, Mont., this plant was operated unsuccessfully and finally was abandoned. No production data are available.

The ore at the Golden Eagle group was mainly an auriferous pyrite occurring as films and coatings in an altered conglomeratic material at its contact with syenite porphyry. The ore body averaged about 3 feet in width; gold distribution was very erratic (34). The average grade is reported to have been about \$8 to \$10 in gold a ton (33). Some of the ore is reported to have been high-grade. According to Edwards, 14 tons of ore averaging \$54 in gold a ton was sacked and shipped.

The deposit was developed by an adit drift about 400 feet long. A winze about 30 feet deep was sunk from this adit. According to Greshchuk, ore from the winze assayed \$9 to \$17 in gold a ton. The adit now is inaccessible.

The ore bodies on the North or Accident group are replacements at or near the contact of limestone and syenite porphyry. Galena, sphalerite, pyrite, and small amounts of chalcopryite with their oxidation products, in a quartz and calcite gangue, occur irregularly in the limestone. The principal deposit on the Accident claim was developed by an adit drift reported to have been about 600 feet long, now inaccessible. In 1944, 47 tons of ore sorted from the old dump was shipped. This ore contained 5,400 pounds lead. The gold, silver, and zinc contents were not reported (28). According to Greshchuk, a sample of the

ore sent to the Washoe sampler at Butte in May 1944 assayed 2.02 percent lead, 0.05 percent zinc, 23.8 ounces silver, and 0.03 ounce gold a ton. Float ore is reported to have been found along the limestone-porphry contact for a distance of about 1,500 feet.

Thomas (Edwards) (Au)

The Thomas claims, formerly known as the Edwards, are on the East Fork of Ford Creek at the mouth of Black Hawk Gulch, about 2-1/2 miles northwest of old Fort Maginnis. The group of three unpatented claims lies to the southeast of the Golden Eagle or Greshchuk group. The claims were located in the early 1880's, worked intermittently by Edwards for several years, and then abandoned. Richard Thomas, Fergus, Mont., later located the claims, which subsequently were operated by Chicago men, who built a small cyanide plant. Thomas now holds the claims by location.

Production data for early-day operations are not available. In 1937 production was reported to have been 11 ounces gold and 2 ounces silver from 23 tons of ore. Between 1940 and 1942 production was 26 ounces gold and 9 ounces silver from 244 tons of ore (28).

The deposit occurs along the contact of Benton shales and a syenite porphyry dike. The ore minerals are auriferous pyrite with possibly some tellurides and free gold; they occur in small cracks and seams in a zone 1 to 11 feet wide. The deposit has been developed by four adits and a 30-foot winze sunk from one of the lower adits. According to William McVeda, Lewistown, Mont., who sank the winze for Thomas, the mineralized zone as exposed in the winze is about 30 inches wide and assays about \$18 a ton in gold. A heavy flow of water prevented further sinking. The adits now are partly caved and generally inaccessible.

Big Spring (Pb-Ag)

The Big Spring group of one unpatented and eight patented claims is on Pilgrim Ridge, which extends northwestward from Elk Peak. The claims are about half a mile north of the Golden Armells and Armells Bonanza claims and approximately 9 miles east of Hilger. The claims were located in the early 1880's by the Gies brothers, who later patented eight of them. Considerable work was done before they were abandoned. In 1947 the Big Spring group was purchased at tax sale by Charles Edwards and then sold to Frank Roe and James Clark, 3012 Kennedy Street, Butte, Mont.

Several small replacement-type ore bodies containing argentiferous galena and sphalerite occur at or near the contact of syenite porphyry and limestone. These ore bodies have been explored by numerous open cuts and short adits. Several shallow shafts were sunk. No production records are available.

According to Edwards, the ore contains about 35 percent lead, 18 or 20 ounces silver, and about \$6 in gold a ton. On the Keno claim, a shallow shaft was sunk on a deposit about 16 inches wide. This ore assayed about \$3 in gold a ton. In 1948 most of the old workings were inaccessible.

Sutter (Cu-Fe)

The Sutter mine is near the top of a low ridge extending northward from Red Mountain, near the headwaters of West Armells Creek, about 8-1/2 miles southeast of Hilger.

The property was located in 1884 by Anderson and Rhodes. In 1916 the abandoned claims were located by Bart Noble and Ed Sutter. In the same year, 62 tons of ore containing 8,218 pounds copper and 60 ounces silver was shipped to a smelter (28). Some development work was done in 1918 and 1919, and two small lots of ore were shipped (15). The claims were abandoned later and subsequently were located by R. S. Hamilton, who sold a half interest to Harry F. Goll of Milwaukee, Wis. The claims were relocated in June 1945 as the Tad, Consuela, and Marjorie. They now are owned by Harry F. Goll and Mrs. John Wagner, 115 Seward Ave., Evanston, Ill. In 1944, 51 tons of ore assaying 6 percent copper was shipped. This shipment was not profitable. An access road was constructed to the mine early in 1945. An area near the old adits was leveled by a bulldozer at that time, but nothing further has been done since then.

The narrow ridge on which the ore body occurs is composed mainly of syenite porphyry, but its north end and east side are covered with a mantle of limestone. The ore body, as exposed near the top and on the west side of the ridge, is an iron gossan roughly in the form of a bulb that tapers and narrows at the southeast. This gossan deposit, approximately 100 feet across at its widest exposure, occurs in the syenite porphyry about 250 feet southwest from the limestone-porphry contact. It can be traced to the southeast for about 1,300 feet.

Small amounts of copper oxide and carbonate occur on the southwest side of the widest part of the gossan as coatings and fracture fillings irregularly scattered over a length of about 75 feet. The copper minerals are more noticeable near small dikes of dark colored phonolite porphyry that have intruded the lighter colored syenite porphyry. The iron gossan apparently is the result of the oxidation and leaching of iron pyrite and some sporadically distributed chalcopyrite. No iron pyrite or copper sulfide minerals are in evidence.

The copper ore shipped was mined from a shallow shaft and several short, shallow adits in the gossan. A crosscut adit 364 feet long has been driven 58 feet below those surface workings; it did not reach the porphyry-limestone contact. Near the entrance to this adit, some copper oxides and carbonates occur along seams in the altered porphyry. Farther inside the adit and below the upper workings, several oxidized zones are crossed. These zones range in width from 2 to 30 feet; they are composed of altered porphyry in which iron oxides occur in cracks and seams. No sulfides were noticeable in this adit. When visited in 1948, the lower adit was open and in good condition. The shaft was closed, and the upper adits were partly caved.

Nine samples were taken in this lower adit by the Bureau of Mines in 1945. These channel samples ranged in length from 13 to 43 feet; they assayed from a trace to 0.96 percent copper.

White and Gilpatrick (Last Chance and Independent) (Pb-Ag, Cu)

The White and Gilpatrick claims are owned jointly by Mrs. Bertha U. Phelan, Lewistown, Mont., and Marjorie Dysart, 25238 8th St., Cuyahoga Falls, Ohio. These claims, in two groups, are on West Armells Creek, about 7 miles southeast of Hilger. One group of four patented claims, known as the Last Chance, is on

the east side of West Armells Creek and adjoins the Old Cave claim at the southeast. The Independent group of three patented claims is on the west side of the creek and adjoins the Sutter claims at the west.

In the Last Chance group, galena, sphalerite, chalcopyrite, pyrite, and their oxidation products occur along bedding planes in limestone at or near the contact of syenite porphyry. About 500 feet to the northwest is a similarly mineralized, narrow quartz vein in the syenite porphyry.

The workings in deposits in the limestone consist of several adits of unknown length and a number of shallow open cuts. A 60-foot adit drift has been driven on the narrow quartz vein in syenite porphyry below the overlying limestone, with a shallow winze about 40 feet in from the portal. Most of the workings now are caved or inaccessible.

It is not known how much ore may have been produced from the Last Chance group of claims. A 5-ton shipment was made in 1936; it is reported to have contained 3 ounces gold and 160 ounces silver (28). A Bureau of Mines sample taken across a 4-1/2 foot width of oxidized material exposed in the side of one of the open cuts assayed 0.01 ounce gold, 2.29 ounces silver, 1.3 percent lead, and 0.05 percent zinc.

Gossan deposits on the Independent group are similar to but smaller than those on the adjoining Sutter claims; they occur in syenite porphyry. These deposits contain iron oxides mainly, with scattered small amounts of cuprite, azurite, malachite, and chrysocolla. These minerals are present as coatings and fracture fillings. On the Independent No. 2 claim, a narrow siliceous replacement occurs along a fracture in altered syenite porphyry near the porphyry-limestone contact. Sparsely distributed chalcopyrite and pyrite in quartz are confined mainly to a maximum width of about 2 inches. A 110-foot adit has been driven on this deposit. This adit was accessible in 1948, although the cuts and pits in the gossan deposits were closed by caving and sloughing.

Big Chicago (Au)

The Big Chicago claim is in the narrow valley between Collar Peak and Maginnis Mountain, about 3 miles northwest of old Fort Maginnis. It was located in the early days and developed by a timbered shaft and an adit (34). After being abandoned for many years, it was reopened about 1916. During that year, a 15-ton cyanide plant was operated for a short time (14). Since then the mine has been idle. The claim is owned now by Larry Smith, 1445 Queens' Way, Hollywood, Calif.

The ore deposit occurs along the contact of black slates and a syenite porphyry dike; it is similar to that at the Voltaire mine (34). The extent of the development work is not known. No production data are available.

Copper Queen (Hamilton) (Cu)

The Copper Queen group of five unpatented claims is on the northeast side and near the top of Red Mountain, about 4 miles southeast of Hilger. The claims

were located by R. S. Hamilton and after some years were relocated by him. No ore has been produced.

Sparse copper mineralization occurs at places in a wide phonolite or rhyolite porphyry dike, which cuts the main mass of syenite porphyry in an easterly direction. A 135-foot adit has been driven through the dike, across unaltered syenite porphyry, and for a short distance into a second phonolite dike. The contacts along the dikes are clean, sharp, and show very little alteration. Near the portal of the adit, iron oxides with small amounts of copper carbonate and silicate occur in cracks and seams. Very small amounts of pyrite and chalcopyrite probably are disseminated in the phonolite dike but are not discernable. When visited in 1948, the adit was open and in good condition.

Golden Jack (Au-Ag)

The Golden Jack mine is at the headwaters of Brickyard Creek, about 7 miles south of Fergus or about 5 miles northeast of old Fort Maginnis.

Three claims were located in the early 1880's by John Lee. The claims were acquired subsequently by a company and were developed extensively. Legal difficulties arose, and Lee finally regained the property. The property then was leased to Dick Thomas of Fergus and Harry Oquist of Lewistown, Mont., and was operated for them by the Bliss Mining Co. After Lee's death, control of the property was acquired by Gene Hunt, Lawrence Olson, and others of Lewistown, Mont. No production records are available before 1933. Between 1933 and 1940 production is reported to have been 75 ounces gold, 56 ounces silver, and 54 pounds copper from 66 tons of ore (28).

The ore occurs in narrow veins in and alongside small phonolite or tinguaitite porphyry dikes that cut syenite porphyry. The dikes and the adjoining syenite porphyry are altered and silicified irregularly. The ore minerals are mainly pyrite and chalcopyrite in a gangue of quartz, calcite, and purple fluorite. The gold and silver apparently occur in the form of tellurides, although some native gold may be present. Crystals of sylvanite are reported to occur in fluorite in the altered silicified porphyry (5).

Three separate veins strike about N. 25 W. and dip about vertical. One of these veins was developed by two adit drifts 125 feet and 340 feet long and by several small surface open cuts. As exposed in the longer adit, the vein ranged from half an inch to about 5 inches in width over a length of about 250 feet. The second vein, about 250 feet to the south, was explored by a 250-foot adit. As exposed in this adit for a length of about 200 feet, the vein was stoped about 6 feet above the drift for a length of about 27 feet. A third vein was reached in the face of a 95-foot crosscut adit driven northwesterly about 300 feet south of the No. 2 vein. The full width of the vein is not exposed. A fifth adit was driven about 100 feet southeast of the 95-foot adit through unaltered syenite porphyry; it encountered no ore. The lengths of the veins have not been determined. All of the adits were open and in good condition in 1948.

Linster (Au)

The three unpatented claims now held by Peter Linster of Lewistown, Mont., were located originally by John Lee. Subsequently abandoned, they were relocated

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by Peter Linster and Charles Barron. After Barron's death, they were again relocated by Linster. The Linster claims are near the headwaters of Brickyard Creek, about 7 miles due south of Fergus; they adjoin the Golden Jack claims at the south.

Syenite porphyry has been intruded by dikes of tinguaitite or phonolite porphyry that have been altered and kaolinized. In places these dikes contain narrow quartz-filled veins containing scattered small amounts of pyrite.

The underground development consists of three adits, 130, 44, and 35 feet long, and a 47-foot shaft. No sulfide minerals are noticeable in the dike where cut by the 130-foot adit, and none could be seen on the dump of the caved shaft. The 44-foot adit driven in syenite porphyry followed a narrow quartz stringer for about 14 feet. The 35-foot adit was driven in a phonolite dike along a 1- to 3-inch quartz vein containing a little scattered iron pyrite. All of the adits are open and in good condition.

Lucky Strike (Ag)

The Lucky Strike claim is on Brickyard Creek about 1 mile west of the Golden Jack group and about 7 miles south of Fergus. The claim was located in the early 1880's. Only a small amount of work was done before it was abandoned. It now is held by location by Daniel J. Ruddy of Fergus, Mont.

The ore occurs in replacement bodies at the contact of syenite porphyry and overlying shaly limestone. The ore minerals are pyrite, with possibly some silver sulfides or tellurides, in a gangue of quartz, calcite, and purple fluorite. A new adit drift was being driven in 1948; it was 70 feet long when seen in June. About half a ton of ore was piled near the adit portal. According to Ruddy, the ore contains up to 20 ounces silver a ton, with small amounts of gold.

Blue Goose (Au)

The Blue Goose claim is at the upper headwaters of Edwards or Little Box Elder Creek, about 6-1/2 miles due south of Fergus. It was located and is still held by Charles Kirby of Lewistown, Mont.

The ore deposit is a replacement at the contact of syenite porphyry with an overlying limestone remnant. Both the limestone and the porphyry have been altered and kaolinized. The ore minerals are pyrite, galena, and sphalerite, with small amounts of chalcopryite, and their oxidation products. Segregations of ore composed mainly of pyrite, with small amounts of galena, sphalerite, and chalcopryite, also occur in irregular, silicified areas in the limestone near the contact.

According to Kirby, two truck loads of sorted ore were shipped to a smelter. Samples of this ore assayed \$12 to \$23 gold a ton.

Three adits, 140 feet, 60 feet, and 14 feet long, have been driven; the longer adits reached the contact, but the 14-foot adit was in limestone above the contact. When visited in 1948, the 140-foot adit was caved. The 60-foot

adit was partly open but in poor condition. Two small compressors, one small gas engine, and one old steam tractor engine, all apparently in working order, have been left out in the open on the dump near the upper adit.

Montclair (Landheim) (Pb-Zn)

The Montclair or Landheim group of claims is near the top of the east side of the divide between the upper forks of Brickyard Creek and one of the upper tributaries of Box Elder Creek, about 6-1/2 miles south of Fergus. The claims are held by location by Gunvald Landheim of Lewistown, Mont.

On the Montclair claim, a cut has been made by a bulldozer in an altered syenite porphyry dike cutting limestone. When examined by a Bureau of Mines engineer in 1944, scattered disseminations of pyrite and chalcopyrite were reported to have been seen in the side of the open cut. A small quartz vein containing bunches of galena and sphalerite also was reported as extending from the dike into the contacting limestone.

When visited in 1948, the side of the cut had sloughed. No sulfide minerals could be seen.

West Armells Creek (Fe)

The iron-bearing deposit near the head of West Armells Creek is about 6 miles east of Hilger. Parts of the deposit have been removed by stream erosion during high water. Limonite and some manganese had have been deposited from solution, mainly as a cement in the alluvial and detrital materials in the narrow valley. Where conditions were favorable, thin beds, mainly of limonite, were deposited. Stems and branches of trees and pine needles are conspicuous in the deposit. The iron and manganese apparently originated through the decomposition and leaching of sulfide-bearing porphyry formations in Red Mountain at the head of the creek.

The deposit ranges in width from about 20 feet to 300 feet. Where exposed along the banks of the creek, the thickness ranges up to 20 feet; in some places it may be considerably thicker.

A similar but smaller iron-bearing deposit is exposed along the banks of upper Edwards or Little Box Elder Creek. The waters of West Maginnis Creek, also known as the West Fork of Ford Creek, have been and are still depositing iron carbonate in the creek bed (34).

Other Mining Claims

Numerous other mining claims have been located in the various mining districts of the county, but little information concerning them is obtainable. Some of these claims have been productive of a small amount of ore. Among these claims are the following: Betty (Ag), Gold Crop (Au, Ag), Gladstone (Au), Mickey (Ag), Monte Cristo and McKee (Au, Ag), Rocky Point (Au, Ag), Silver Reef (Ag), Windy Bill (Au, Ag, Pb), Bob Cat (Au, Ag), Dawes and Golden (Au, Ag), Cone Butte (Au, Ag, Cu), Dardanelles (Au, Ag, Cu), and Double Jack (Pb, Ag) (28).

NONMETALLIC MINERAL DEPOSITS

Deposits of gypsum, clay, kaolinite, travertine, limestone, marble, silica sand, sandstone, and bentonite occur in widely scattered areas in Fergus County. Only a few of these deposits have been exploited. The gypsum deposits at Heath and Hanover and the clay deposit at Lewistown provide raw materials for processing in the nearby plants.

Gypsum

Large areas in Fergus County are underlain by beds of rock gypsum. According to O. W. Freeman (9), the beds are believed to be of Jurassic age and resulted from the evaporation of sea water; some gypsum beds may be of late Carboniferous age. They outcrop at many places in the foothills of the Big Snowy, Judith, and South Moccasin Mountains. Beds of gypsum 20 to 30 feet thick occur on Alaska Bench northeast of the Big Snowy Mountains and near the N-ranch northwest of Tyler. Gypsum also outcrops near U. S. Highway 87 about 7 miles east of Lewistown; near the point of the sharp bend in the Chicago, Milwaukee, St. Paul, & Pacific Railroad tracks, about 11-1/2 miles southeast of Lewistown; on the East Fork of Big Spring Creek; southeast of Moore; at Heath; and at Hanover. Only the deposits at Heath and Hanover are being mined.

U. S. Gypsum Co. (Heath)

The U. S. Gypsum Co. mines and processes gypsum at Heath, Mont. Heath is on the Winnett branch of the Chicago, Milwaukee, St. Paul, & Pacific Railroad, 11 miles east of Lewistown.

The gypsum deposit at Heath was prospected first by the Northwest Gypsum Co. This company began mining this deposit and constructed a processing plant in 1915. The U. S. Gypsum Co. acquired all of the Northwest Gypsum Co. holdings in 1928. Only crushed gypsum and calcined gypsum were produced before 1936. New modern plants were erected and equipped in 1936. Since then, the U. S. Gypsum Co. has been mining 450 to 500 tons of crude gypsum a day. Some of the gypsum is crushed and shipped to cement plants; some is ground and marketed as a soil conditioner. The larger part, after fine grinding, is calcined in two large batch-type calcining kettles. Some calcined gypsum is marketed for plaster; most of it is used in the company's plant in producing wallboard and plaster laths. The U. S. Gypsum Co. at Heath now owns or holds the mineral rights to 770 acres of land in secs. 1, 2, 11, and 12, T. 14 N., R. 19 E.

The gypsum bed being mined outcrops along the hillside just north of the railroad tracks and about 100 feet above the valley floor. The bed occurs between layers of shaly limestone in the Ellis formation; it is flat-lying and ranges from 10 to 15 feet in thickness. It is overlain by a rock cover that has a maximum thickness of about 275 feet where now mined. The gypsum is of high purity. The bed contains some irregular narrow bands of dark-colored, shaly limestone and clay. About 2 to 3 feet of the top of the bed is left to overcome slabbing of the overlying shaly limestone. All material mined is sent to the crushing plant. As mined, the broken rock is nearly pure gypsum; it contains virtually no free silica or iron oxides and less than 1 percent calcium carbonate.

The early-day underground workings have been abandoned. The present workings have been developed from a long adit driven in the bed about centrally in the deposit. From the adit, which is the main haulageway, openings have been driven outward about 150 feet apart to the right and left at 45° angles to the limits of the development. From one side of these openings, rooms 22 feet wide are driven through to the next opening, leaving a pillar 16 feet wide between rooms. Pillars are subsequently removed by retreating from the outer edges of the developed deposit. About 90 percent of the gypsum bed, as mined, eventually is recovered by this method.

The mine workings virtually are dry; the little water that seeps in is drained off through drainage ditches. Ventilation is provided by an electrically driven fan, which provides 40,000 cubic feet of air a minute. Small booster fans are used in the rooms for the quick removal of dust, gas, and smoke. No timber is required for support.

Electric auger drills with detachable bits are used for drilling. These are mounted on adjustable ratchet-jack bars. Twenty to twenty five holes 10 to 12 feet long are drilled for an average round in the rooms. All drilling is done by contract. All blasting is accomplished by electric delay detonators. About 50 pounds of 45 percent blasting gelatin is required for a round; 150 to 170 tons is broken each round. Not more than 10 men generally are employed underground for the two shifts worked.

All broken material is mucked and loaded into cars by a scraper operated from a double-drum slusher hoist. This hoist and the attached ramp are track-mounted. A 6-ton Jeffry electric haulage motor pulls the loaded cars out of the mine and delivers them to the crushing plant.

Electrically operated equipment is used in the mine and surface plants. Electric power is provided by the Montana Power Co. from its high-tension line, which extends to the property from Lewistown. The total connected motor capacity is about 1,500 horsepower. Actual power used amounts to about 1,000 horsepower.

Three Forks Portland Cement Co. (Hanover Gypsum)

The Three Forks Portland Cement Co., a subsidiary of the Ideal Portland Cement Co. of Denver, Colo., which also operates a cement plant at Trident, Mont., owns or controls the mineral rights in approximately 3,200 acres. This land is mainly in secs. 10, 11, 12, 13, 14, 15, 22, and 27, T. 16 N., R. 17 E., in the vicinity of Hanover, Mont. Hanover is 9 miles west of Lewistown on the Chicago, Milwaukee, St. Paul & Pacific Railroad and the Great Northern Railroad.

The company began mining gypsum and constructed its crushing and plaster plant at Hanover in 1917. The operation has been continuous since its beginning, although production has fluctuated according to market conditions. During the past few years, however, mine production has been maintained at about 5,000 tons of crude gypsum a month. Crude crushed gypsum is sold to cement plants; ground gypsum is marketed as a soil conditioner; calcined gypsum is produced for plaster. The company does not produce plasterboard or lath.

The two gypsum beds being mined occur along the south side of a small domal structure in the Ellis formation. The gypsum beds, which average about 10 and 12 feet in thickness, have about a 60-foot thickness of limestone between them; they dip about 15° SE. at and near the surface, but flatten at depth to about 5°. To the northwest, about 1,500 feet from the plant, the beds have been cut off by a fault, beyond which they have not been found. The beds, however, continue in a northeasterly direction for a known distance of more than 1 mile; they may continue down the dip for several miles.

The gypsum is fine-grained, light gray in color, and of high purity. Some irregular, unconformable, narrow bands of dark-colored, shaly limestone and clay occur in the gypsum beds; but these do not materially affect the quality of gypsum produced. According to J. R. Gwin, plant superintendent, the material as mined contains an average of about 92.4 percent gypsum, 2.6 percent anhydrite, 4.4 percent calcium oxide, and 0.6 percent silica, iron, and alumina.

The upper bed first was mined by open-cut methods. Later, a vertical 3-compartment shaft was sunk to a depth of 100 feet, cutting both beds. The lower bed was developed from a main haulage drift driven from the 80-foot shaft level. Crosscuts were driven from the lower bed to the upper bed, along which a main drift was driven. From these main haulage drifts, rooms were opened at 90° angles at 60-foot intervals. These rooms first are driven 8 feet wide and to a height equal to the thickness of the beds, and then are widened gradually to 25 feet, a pillar 35 feet wide being left between rooms. A wall pillar 10 feet wide is left between rooms along the side of the haulage drifts. Pillars eventually will be mined by retreating.

All holes for blasting are drilled dry by jackhammer air drills or electric auger-drills. The usual round requires 20 to 25 holes and about 50 pounds of 45 percent blasting gelatin. Cap and fuse and electric delay detonators are used; 80 to 170 tons of gypsum are broken a round.

The broken gypsum is scraped to chutes or directly into cars or is loaded into cars by shovel loader. A 4-1/2-ton Diesel haulage locomotive pulls the loaded cars to the shaft-loading pocket, where they are dumped. Hoisting to the surface is done in 1-ton skips.

Natural ventilation through numerous raises and other openings to the surface provides an abundant supply of fresh air. The small amount of water in the workings drains to a common sump, from which it is pumped to the surface by a centrifugal pump directly connected to a 10-horsepower electric motor. This pump requires operation for only about 1 hour a day. From 25 to 30 men generally are employed at the mine on a 2-shift basis.

The crude gypsum sold to cement plants is crushed to minus 2-inch and then loaded directly into box cars for shipment. The remainder of the gypsum mined is ground to 98 percent minus 100-mesh in a Raymond hammer mill. Some of this product is sold as soil conditioner; the rest goes to the plaster plant, where it is calcined in two coal-fire-heated, batch-type, calcining kettles. Calcining is accomplished in 2 hours at 250° to 260° C. Each kettle has a capacity of about 11 tons of gypsum, from which about 9 tons of plaster

is attained. After calcining, this material goes to a tube mill, where it is ground to minus 200-mesh.

The electric power used by the mine, the crushing plant, and the calcining plant is supplied by the Montana Power Co. through a branch line from its main high-tension line between Great Falls and Lewistown. The connected motor load is about 1,000 horsepower. Actual power used amounts to about 600 horsepower.

Clay

Lewistown Brick & Tile Co.

The Lewistown Brick & Tile Co. has been manufacturing brick and tile at its plant just east of the Lewistown city limits since 1911.

The plant obtains its principal raw material from a thick bed of maroon-colored shaly clay interbedded with thin layers of shaly sandstone in the Kootenai formation. After stripping off the overburden, the upper 35 to 40 feet of this bed is mined from an open-cut about 500 feet distant from the plant. Drilling and blasting are necessary. The broken material is transported to the plant by Carryall scraper.

The material is ground, thoroughly mixed, and then tempered in a vacuum machine, to which a small amount of barite is added. This machine extrudes the mixture, which then is automatically cut into brick- or tile-shaped blocks. The brick and tile blocks are dried for about 5 days in drying sheds heated by waste heat from the kilns. Then they are burned in coal-fired beehive-shaped kilns for 5 to 6 days. Each of the six kilns now in use has a capacity of 70,000 bricks. About 500 pounds of coal is required to burn 1,000 bricks.

According to the estimate of the manager, J. W. Gretenacort, production during 1947 was about 2-1/4 million bricks and 2,500 tons tile. The bricks are hard, tough, and vitreous. They have been shipped to many localities throughout the Northwest. Electric power for plant operation is supplied by the Montana Power Co. The connected motor load is 195 horsepower. Actual power consumption is not known.

Whiteware Clay

The Whiteware Clay deposits are on the southeast side of the South Moccasin Mountains on the east slope of a ravine locally known as Deihl Gulch, in the SW1/2 of sec. 2, T. 16 N., R. 17 E. They are 3-1/2 miles northeast of Hanover, Mont.

Clay outcrops on the ranch owned by Glenn C. Morton were investigated first in 1936. Samples sent to various laboratories indicated that they contained a high percentage of available alumina and had qualities that made the clay suitable for the manufacture of chinaware and other ceramic products. Three lode claims then were located by Glenn C. Morton and H. L. DeKalb of Lewistown.

Sandstones, shales, and arkosic rocks were intruded, lifted, and broken by rhyolite and syenite porphyries. The clay deposits were formed by hydrothermal action, which kaolinized, to varying degrees the brecciated zones, certain other areas of fragmental rocks, and parts of the more pervious sandstone and shale beds. Some of the breccia was completely altered and replaced.

In 1943 the Bureau of Mines excavated 29 trenches and diamond core-drilled 13 vertical holes ranging from 24 to 336 feet in depth. The combined length of the drill holes was 1,241 feet. This investigation was made in the search for suitable sources of high-alumina clay for the production of alumina. High-alumina clay cut in four of the drill holes was 5-1/2 to 30 feet thick and averaged 31.2 to 36.7 percent available alumina and 0.3 to 1.4 percent available ferric oxide. Some surface samples approached the composition of pure kaolinite. Refractory tests made on samples taken from some of the trenches and from the adit dumps showed the material to fire white and indicated its suitability for the manufacture of whiteware. High refractory properties were indicated by the P. C. E. tests, which registered equivalents ranging from 33 to 34 plus (29).

Although the available alumina and ferric oxide contents of much of the clay appear to meet the requirements for aluminum production, the clay bodies are too small and too irregular in form and occurrence to permit further consideration for such production on a commercial scale. However, the clay is indicated to be of a quality suitable for the manufacture of certain white-ware, refractories, and other ceramic products; it could be used also by the paper, paint, and rubber industries. None of the clay has been mined, processed, or shipped, except for analysis and testing.

Travertine

During the early Quaternary period, following a long period of erosion, large springs rising in or around the edges of the igneous rocks flooded large areas. From these spring waters, deposits of travertine were precipitated. Later, erosion removed most of the deposited material, but large remnants still remain in the vicinity of the mountains (4). The largest remnant, covering an area of about 6 square miles, lies between the North Moccasin and South Moccasin Mountains, about 12 miles northwest of Lewistown. This area, known as "The Park," is blanketed with a mantle of travertine ranging in thickness from a few feet, where it overlies the Ellis formation at its northern border, to 250 feet on the south, where it has been exposed by erosion along some of the tributaries of Warm Spring Creek (1).

Another large deposit of travertine occurs as a capping of Flat Mountain on the south side of the Judith Mountains, about 9 miles northeast of Lewistown. Other smaller travertine remnants remain on the west side of the South Moccasin Mountains, as a capping of Rocky Butte on the northeast side of the South Moccasin Mountains, and near the center of a domal structure about 3-1/2 miles northeast of Heath (4).

Samples of the travertine from "The Park" analyzed 53.7 percent calcium oxide (CaO), 0.51 percent magnesium oxide (MgO), 0.95 percent silicon dioxide (SiO₂), and 0.20 percent ferrous oxide (FeO) (1).

Except for the production of lime for local use, none of the deposits have been exploited. In 1948 most of the lime used in the Lewistown area was obtained from sources outside Fergus County.

Limestone

Limestone occurs abundantly in Fergus County. Massive, thick-bedded limestone of Carboniferous age outcrops at many places along the slopes of the mountain ranges. The Big Snowy Mountains, in the southern part of the county, are composed mainly of limestone, which ranges in composition from dolomitic to very pure limestone free of magnesia (9). A large deposit of very pure limestone is exposed in the Judith Mountains at the upper end of Dexter Gulch, about 6 miles southeast of Brooks, in secs. 11, 14, and 15, T. 16 N., R. 19 E., on land owned by C. D. Clark, Lewistown, Mont., and on adjoining sections. Samples of this limestone, analyzed by various sugar-manufacturing companies, are reported by Clark to contain more than 98 percent calcium carbonate.

A deposit of limestone about 3 miles north of Hanover formerly was mined by Three Forks Portland Cement Co. and utilized in the manufacture of cement. The limestone was brought to the plant at Hanover by aerial tramway. Operations at the cement plant were discontinued about 1931; most of the equipment was transferred to the company's plant at Trident, Mont.

Marble

In the Button Butte area, 5 to 6 miles southeast of Grass Range, the limestones have been recrystallized to white, cream, and chocolate-colored marble. A mountain ridge in the southern part of the Judith Mountains, west of the headwaters of Ruby Gulch, is known as "Marble Mountain." This area, about 7 miles northeast of Lewistown, contains large deposits of white, blue, and mottled marble. The marble in both of these deposits is said to be suitable for use as building stone or monuments and to take a high polish.

Silica Sand

A deposit of silica sand has been exposed by road construction about 3 miles southwest of Hilger on State Highway 19 in sec. 23, T. 17 N., R. 18 E. This deposit is composed of loosely consolidated sand under a shallow capping of overburden. The sand is light gray in color; the grains are slightly rounded. The bed has been exposed for a horizontal distance of about 75 feet and for about 15 feet vertically. It apparently extends over a considerable area. A Bureau of Mines channel sample across a 7-foot thickness of the lower part of the exposure was subjected to screen and chemical analysis with the following results:

Screen analysis

<u>Product, mesh</u>	<u>Weight, percent</u>
+28.....	0.0
+35.....	.3
+48.....	23.7
+65.....	39.8
+100.....	21.8
+150.....	3.5
+200.....	1.2
+270.....	0.9
-270.....	8.8
	<u>100.0</u>

Chemical analysis, percent

<u>SiO₂</u>	<u>Fe₂O₃</u>	<u>Al₂O₃</u>	<u>CaO</u>	<u>MgO</u>	<u>Na₂O</u>	<u>K₂O</u>
91.8	0.28	4.31	0.06	0.10	0.08	0.69

These analyses indicate that the sand may be of a quality suitable for use as an iron moulding or foundry sand, or for the production of green or amber glass. Except for small local use for construction material, none of this sand has been mined or shipped.

Sandstone

A very dense, fine-grained, reddish-gray sandstone bed in the Kootenai formation has been mined a short distance east of Lewistown, Mont. This stone is easily cut and shaped and is highly resistant to weathering. It was used in the construction of the Power building in Lewistown and for other local building.

Bentonite

Deposits of bentonite occur interbedded with Colorado shales of Cretaceous age near Beaver Creek, about 8 miles west of Lewistown on U. S. Highway 87. The bentonite is in thin beds 1 to 2 feet thick and is overlain by considerable overburden. Other beds 4 to 6 feet thick are reported to occur near State Highway 19 between Lewistown and Winifred. None of this material has been mined on a commercial scale, although some has been used by ranchers for lining irrigation ditches.

Other Nonmetallic Minerals

Gem sapphire and topaz are reported to have been found during development work at the West Kendall mine on the west site of the North Moccasin Mountains (10).

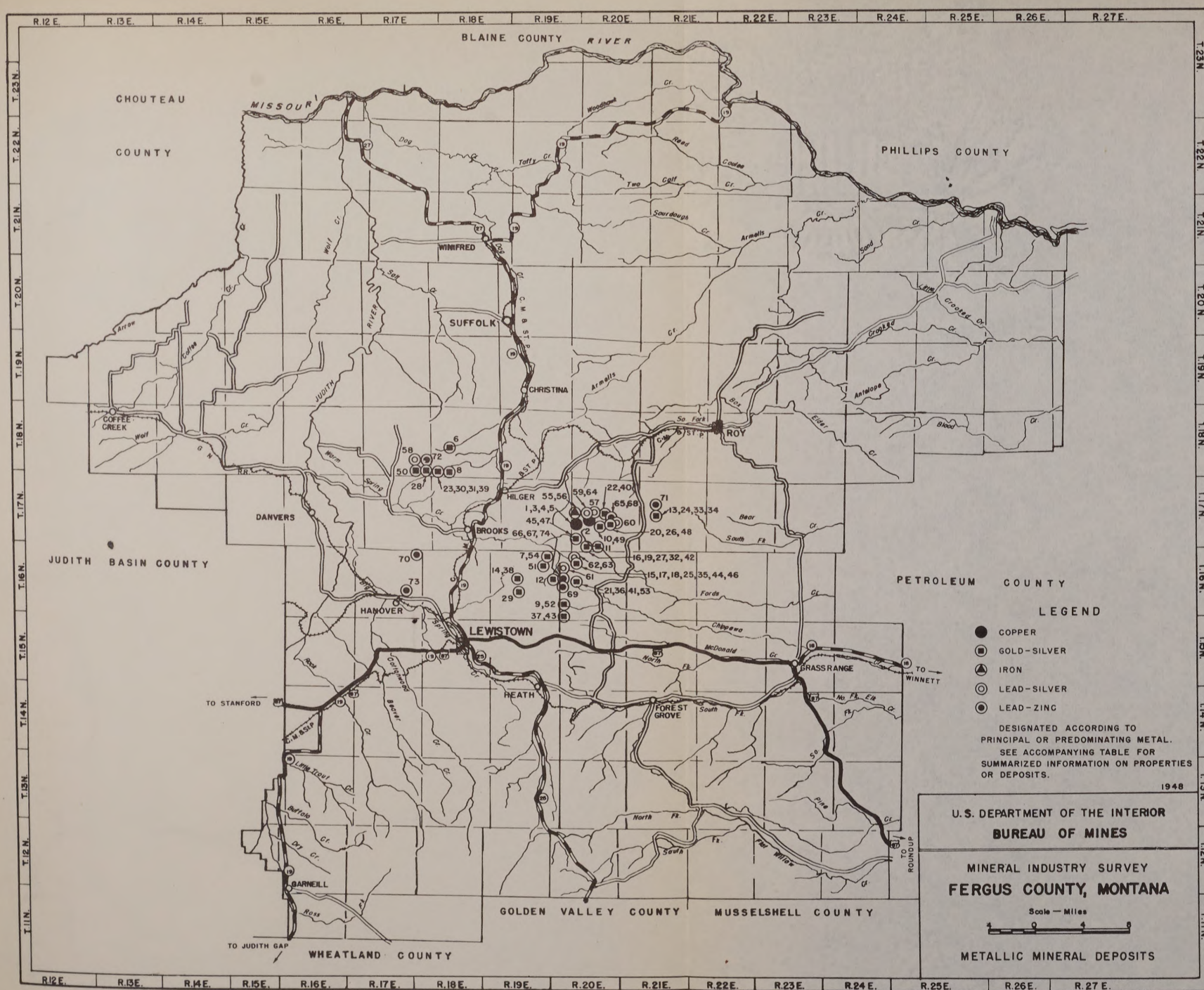


Figure 6.

MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/

Map ref. no.	Name of property or deposit 2/	Location			Description of deposit	Indicated metal content		Reported production	Remarks
		Sec.	T.	R.					
● - Copper									
1	Bolivia (Hamilton Copper Prospect)	19	17N	19E	Disseminated chalcocite with copper oxides and carbonates in altered rhyolite porphyry near a granite porphyry intrusive. Mineralization irregular.	0.02 to 0.12% Cu; traces Au and Ag.	None		One adit in good condition. In isolated location.
2	Copper Queen (Hamilton Copper Prospect)	20	17N	20E	Copper oxides and carbonates sparsely disseminated in phonolite porphyry dike. No sulfides exposed.	?	None		Prospect only. One adit in good condition. In isolated location.
3	Northern Pacific (American Flag)	19	17N	20E	Quartz-calcite vein in altered phonolite porphyry dike. Reported up to 10 ft. in width and to contain to 35% fluorite, with small amounts of Cu, Pb, Au, and Ag.	Reported to average about \$15 a ton.	None. In 1897, 500 tons reported on dumps.		In isolated location. No road. Old workings inaccessible. Not worked since 1897.
4	Sutter (Hamilton-Sutter)	18	17N	20E	Oxidized zone in syenite porphyry. Iron gossens with copper carbonates and some oxides.	Sorted ore shipped assayed 6% copper.	Sorted ore shipped - 62 tons in 1916; 51 tons in 1944.		Main adit in good condition; other shallow workings caved. Secondary zone of enrichment may exist at depth.
5	White and Gilpatrick (Independent Group)	18	17N	20E	Scattered copper oxides and carbonates in iron gossans. Deposits lense shaped. Also a small vein in porphyry contains copper, lead and zinc sulfides.	?	None		One adit in porphyry in good condition. Surface cuts caved.
● - Gold-Silver									
6	Abby and Abby Extension	20	18N	18E	Replacement deposits in limestone at or near limestone-syenite porphyry contact.	Reported to assay \$2.50 to \$10.00 in Au a ton.	None		Inactive since 1910; 175-foot shaft and 1,000 feet of development work. Some ore reported as developed.
7	Allen Silver (Silver Dike Group)	1,2	16N	19E	Silver sulfides and tellurides associated with fluorite in silicified, brecciated bands in limestone. Small amount of gold also present. Extensive.	Ave. of 280 samples reported to contain 18 oz. silver a ton.	Earlier day production unknown. 1,272 tons, containing 63 oz. Au and 27,953 oz. Ag since 1900		Inactive since 1940. Some workings accessible. Partly amenable to open-cut mining methods.
8	Barnes King (North Moccasin Mines Syndicate)	32	18N	18E	Replacement deposits in limestone at or near limestone-syenite porphyry contact. "Black", or unoxidized ore, interbedded with shaly limestone at depth. No sulfide.	\$3 to \$10.00 for ore milled.	1900-1910 not reported. 1911-1922, bullion sold totaled \$2,167,313 in value.		Underground workings inaccessible. Ore not free milling. Black ores required roasting before cyanidation. All former Barnes-King properties acquired by North Moccasin Mines Syndicate about 1940.
9	Bay Horse	30	16N	20E	Silver sulfides and tellurides in brecciated bands in limestone.	?	Production 1935-1939 reported as 6 oz. Au and 4,604 oz. Ag from 149 tons of ore.		Last operated by lessees in 1939. Now owned by Gilt Edge Mining Corporation
10	Big Chicago	21,28	17N	20E	Replacement deposits along contact of black slates or shales and a syenite porphyry dike.	?	No available records.		Small cyanide plant operated in 1916 when the mine was operated by lessees. Not worked since.
11	Black Diamond	33	17N	20E	Limonite bands in limestone containing gold. 18 inches to 2 feet thick.	Reported as high as \$14 in gold a ton.	None reported.		Extent of workings, if any, not known.
12	Black Hawk (O'Brien)	13	16N	19E	Replacement body at contact of limestone and syenite porphyry. Limestone and porphyry both altered and soft. Gold free in quartz, fluorite, calcite gangue. Some fine specular hematite.	Sorted ore reported to assay \$25 to \$50 in gold a ton.	None reported.		One adit open but in poor condition. Mine not worked for many years.
13	Blue Goose (Kirby)	17	17N	21E	Replacement in limestone near or along limestone-porphry contact. Pyrite, galena, and sphalerite.	Reported to assay \$12 to \$23 in gold a ton.	Two truck loads of sorted ore shipped to smelter years ago.		Development consisted of about 214 ft. of adits. Now caved or in poor condition.

MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/(Continued)

Map ref. no.	Name of property or deposit 2/	Location			Description of deposit	Indicated metal content	Reported production	Remarks
		Sec.	T.	R.				
14	Boulder	16	16N	19E	Replacement bodies in black Silurian limestone near a limestone-porphry contact.	Some picked samples reported to assay 100 oz. in silver a ton.	None	300-foot adit, driven through limestone, now caved.
15	Clara May and Ella	5	16N	20E	Replacement deposits along contact of limestone and syenite porphyry.	One shipment of 28 sacks assayed \$160 in gold a ton.	Three tons of ore shipped to Omaha, Neb., reported to have yielded \$100 a ton in gold.	Between Spotted Horse and Magiana mines. 500 feet of development before 1904. Not worked for many years.
16	Collar	32	17N	20E	Silver sulfides and tellurides in silicified altered limestone.	?	Some production but no records available.	First mill built in Fergus County in 1881-82. Several hundred feet of development work done. Mine workings now inaccessible.
17	Cumberland	5	16N	20E	Large oval-shaped replacement deposit in altered syenite porphyry near limestone contact. Free gold, tellurides, some sulfides with fluorite in quartz and calcite. Also vein along contact.	Ore milled ranged from \$3.20 to \$27.00 in gold a ton.	1903-1923 produced 40,238 tons yielding 15,236 oz. Au and 12,771 oz. Ag.	Mine workings inaccessible. Except for mill clean-up in 1923, no work done since 1918. Mill building burned in 1948.
18	Depression	5	16N	20E	Replacement deposit in limestone near contact with syenite porphyry.	?	In 1935, 120 oz. Au and 389 oz. Ag from 731 tons of ore.	Mine workings now inaccessible.
19	Florence (Get Even)	32	17N	20E	Silver sulfides and tellurides as films and crack fillings in limestone at or near syenite porphyry dike.	7 tons sorted dump material contained 3 oz. Au and 309 oz. Ag.	Small amount of high-grade ore shipped. 17 tons returned about \$9,000.	Mine not worked extensively since 1896. Old dumps have been sorted several times, yielding some ore. Three adits still accessible.
20	Gies (Bertha)	22	17N	20E	Replacement deposits in limestone and in porphyry near limestone-syenite porphyry contact. Auriferous pyrite. Some oxidized ore.	\$4 to \$80 in gold a ton.	Ore assaying up to \$80 a ton in gold reported as shipped in early days.	Main adit 1,500 feet long. Most of mine workings still in good condition.
21	Gilt Edge (Gilt Edge Mining Corporation)	17,18	16N	20E	Mainly replacement bodies in limestone along syenite porphyry contact. Black ores interbedded with shaly carbonaceous limestones at depth. Ore not free milling. No sulfides.	Mill recovery \$0.70 to \$12 in gold a ton.	422,527 tons of ore cyanided 1901-1912. Exclusive of 44,570 tons treated in 1910, yield was 64,480 oz. Au and more than 3,000 oz. Ag.	Many thousand feet of shafts, adits and drifts. Some workings accessible; many caved. Property includes over 40 patented claims. Small production 1913-1918 by lessees. Some exploratory work done in 1940-1941.
22	Golden Armells and Armells Bonanza	15	17N	20E	Oxidized gold ore in a narrow fissure vein in syenite porphyry; also as a replacement deposit along limestone-syenite porphyry contact.	Sorted ore; 0.73 to 0.96 oz. Au a ton.	1936-39, 32 oz. Au, 104 oz. Ag from 41 tons of ore.	Ore not mined below 50-foot shaft level. Several hundred feet of development, partly accessible.
23	Golden Discovery	31	18N	18E	Replacement deposits in limestone at or near limestone-syenite porphyry contact.	?	None.	Some good ore reported, but no commercial ore bodies developed by 500-foot shaft and 350-foot crosscut. Workings now inaccessible.
24	Golden Jack	17	17N	21E	Free gold and tellurides, with purple fluorite, calcite and quartz, in narrow veins, cutting phonolite and syenite porphyry. Some chalcocopyrite and pyrite.	Sorted ore contains about 1 oz. Au and 1 oz. Ag a ton.	No production data available before 1933. Between 1933 and 1940, 75 oz. Au, 56 oz. Ag and 54 lb. copper from 66 tons of ore.	5 adits with total length of about 910 feet. All adits in good condition in 1948. Three separate veins only partly developed.
25	Goodwin	8	16N	20E	Limonite filled fissure veins containing gold in Carboniferous limestone.	?	None reported.	Extent of development work unknown.
26	Greshchuk (Murphy or Golden Eagle Group)	22	17N	20E	Auriferous pyrite as films and coatings in altered schistose zone about 3 feet wide contacting syenite porphyry.	Reported to contain \$8 to \$10 in gold a ton.	14 tons of sorted ore averaging \$54 gold a ton. Date not reported.	A small cyanide plant was unsuccessfully operated. Deposit developed by 400-foot adit and 30-foot winze. Workings now inaccessible.

MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/(Continued)

Map ref. no.	Name of property or deposit 2/	Location Sec. T. R.	④ - Gold-Silver (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
27	Hardscramble	32 17N 20E	Replacement deposit along or near limestone-syenite porphyry contact.	?	3 tons of ore containing 3 oz. Au, 87 oz. Ag and 105 lb. Cu in 1918.	Early history and amount of development unknown.
28	Hazzard (Trader)	36 18N 17E	Replacement deposits in limestone near syenite porphyry contact.	?	None.	Group of 5 patented claims about 1/2 mile west of Kendall mine on main limestone-syenite porphyry contact. Mine workings now inaccessible.
29	Horseshoe and Muleshoe	21 16N 19E	Replacement deposits, along or near limestone-syenite porphyry contact. Galena, sphalerite and chalcopryite with some gold and silver.	Truck shipments reported to assay \$28 in gold silver and copper a ton.	1934-37, 11 tons of ore containing 7 oz. Au, 10 oz. Ag, and 1,751 lb. Cu.	Development included 500 feet of adits, 75-foot raise, and 100-foot shaft. Workings now inaccessible.
30	H and H	31 18N 18E	Replacement deposits in limestone at or near limestone-syenite porphyry contact.	Reported to range from \$14 to \$16 in gold a ton.	None reported.	Developed by 500-foot adit driven in 1904. Inaccessible in 1948.
31	Kendall (North Moccasin Mines Syndicate)	31 18N 18E	Large replacement deposits in limestone and syenite porphyry. Black or unoxidized ore in carbonaceous shaly limestone bands at depth. Ore not free milling. No sulfides.	Average recovery by cyanidation from 693,972 tons mined to 1910, \$5.75 in gold a ton.	Production 1902-34 reported as 195,071 oz. Au, 6,333 oz. Ag from 767,905 tons of ore.	Developed by 600-foot vertical shaft and several thousand feet of drifts and crosscuts, in addition to large open pit. Underground workings now inaccessible. Acquired by North Moccasin Mining Syndicate in 1940.
32	Last Chance	32 17N 20E	Replacement deposits in limestone along or near syenite porphyry contact.	?	In 1925, 25 oz. Au and 43 oz. Ag from 2 tons of ore.	Extent of development unknown.
33	Linster	17 17N 21E	Quartz veinlets in phonolite and syenite porphyry.	?	None	About 210 feet of adits and a 47-foot shaft. Adits open, but shaft now caved.
34	Lucky Strike (Ruddy)	17 17N 21E	Replacement zone along contact of limestone and syenite porphyry. Quartz, fluorite, pyrite, probably some tellurides.	Some selected ore reported to contain up to 20 oz. Ag a ton.	None	Now prospecting by adit drift.
35	Maginnis	5 16N 20E	Replacement deposits along or near contact of limestone and syenite porphyry. Deposits irregular laterally and vertically. Sulfides and tellurides at depth.	Ranged from \$4 to \$5,000 a ton. Average grade of most of ore milled \$7.73 to \$12.56.	About \$1,500,000 from 1881 to 1899. From 1904-40, 18,674 oz. Au, 24,255 oz. Ag, and 21,807 lb. Pb from 34,883 tons of ore.	A 300-foot and a 1,450-foot adit, 225-foot winze, and several thousand feet of drifts and crosscuts. Worked intermittently since 1909 by lessees. Most of mine workings now inaccessible.
36	Mammoth	17 16N 20E	Replacement deposits in limestone along or near syenite porphyry contact. Ore not free milling. No sulfides.	Ore treated - about \$6 in gold a ton.	Some production, but no records available.	A 60-ton cyanide plant operated a short time in 1904. About 250 feet of development by adit done in 1919. No black ores mined. Workings now inaccessible.
37	McEvany (Big Six)	31 16N 20E	Replacement deposits along or near limestone-syenite porphyry contact. Both oxidized and black ores. No sulfides.	Reported at \$4 to \$6 in gold a ton.	Production records not available. Some ore produced and milled at Whiskey Gulch mill before 1904.	Several hundred feet of development. Large quantities of both oxidized and black ores reported still unmined. Workings now inaccessible.
38	New Year	16 16N 19E	Replacement deposits along or near limestone-syenite porphyry contact. No sulfides.		Production 1911-12: 206 oz. Au and 11 oz. Ag from 10,000 tons of ore.	Several hundred feet of adits. Several deposits similar to those near Gilt Edge. 300-ton cyanide mill operated short time. Adits now inaccessible.

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MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/(Continued)

Map ref. no.	Name of property or deposit 2/	Location Sec. T. R.			① - Gold-Silver (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
39	North Moccasin Mine (North Moccasin Mines Syndicate)	31	18N	18E	Replacement deposits mostly in limestone near syenite porphyry contact. Black ore in carbonaceous shales at depth. Ore not free milling. No sulfides.	\$4 to \$12 in gold a ton.	Production 1908-1922; 116,835 oz. Au and 18,485 oz. Ag from 321,232 tons ore.	Several thousand feet of develop- ment. Mine operated for about 10 years by Barnes-King Development Co. Last operated in 1922. Mine work- ings now inaccessible. Acquired by North Moccasin Mining Syndicate in 1940.
40	Old Glory (Bliss)	14	17N	20E	Narrow fissure veins in altered porphyry; also replacements in limestone near syenite porphyry contact. Sulfides and tellurides with purple fluorite.	\$6 to \$14 gold and 3 to 15 oz. silver a ton.	Production 1901-41; 219 oz. Au and 2,086 oz. Ag from 418 tons of ore.	A 100-foot shaft, a 200-foot edit, and a 50-foot open cut. Small cyanide plant constructed in 1935. Last operated by lessees in 1940 and 1941. Workings now inaccessible.
41	Peerless	18	16N	20E	A narrow vein in limestone near syenite porphyry contact. Gold, silver, and copper minerals.	?	Six-ton shipment averaged \$100 in gold and silver a ton.	Located in early 1880's. Now owned by Gilt Edge Mining Corpo- ration.
42	Pilgrim (Ninty Nine)	32	17N	20E	Silver sulfides and tellurides in a narrow quartz calcite vein in limestone.	?	No data available, but made some production.	60-foot and 20-foot shafts, also numerous open cuts. Workings now inaccessible.
43	Ruby Gulch	31	16N	20E	Replacement deposit along or near a limestone- syenite porphyry contact. Values erratic. One small pocket yielded \$4,448 in gold a ton. One chimney contained lead ore.	?	In 1906, 13 oz. Au, 980 oz. Ag, and 99,241 lb. Pb from 108 tons of ore.	500 to 600 feet of adits and a 50-foot winze. Not worked since 1906. Workings now inaccessible.
44	She	5	16N	20E	One short ore shoot in a replacement deposit at or near limestone-syenite porphyry contact.	?	None reported.	A 50-foot adit and a 30-foot winze sunk from the edit. No other information available. Workings now inaccessible.
45	Silver Bullion	30	17N	20E	Replacement deposits in and along narrow fissures in an altered syenite porphyry. Silver sulfides or tellurides associated with purple fluorite, calcite, and quartz.	Sorted ore shipped contained 17 to 63 oz. Ag a ton.	1918-33; 16 oz. Au and 2,090 oz. Ag from 46 tons of ore.	Worked in early days through a 200-foot shaft; later through an adit drift about 50 feet lower in altitude than shaft collar. Mine workings now inaccessible.
46	Spotted Horse	5	16N	20E	Replacement deposits in limestone, in porphyry, and in veins near the limestone-syenite porphyry contact. Deposits range from narrow veins to replacement bodies 80 feet in width. Free gold and tellurides associated with purple fluorite, calcite, and quartz. Ore about 65 percent free milling. Oxidized zone extended to 400 feet.	Ore milled and shipped ranged from \$5 to \$104 in gold a ton.	Estimated production 1883- 1901 about \$3 million. 1902-35, 16,277 oz. Au, 14,925 oz. Ag, and 206 lb. Cu from 17,639 tons of ore.	Several thousand feet of develop- ment. A 450-foot shaft and 135-foot winze below 450-foot level. Six ore shoots mined on 8 levels. Ore mined on 8th level averaged \$22 a ton. Heavy flow of water prevented deeper exploration.
47	Tail Holt	30	17N	20E	Replacement deposits along narrow fissures in syenite porphyry. Free gold and tellurides in a gangue of quartz, calcite and purple fluorite. Higher gold content than found in same veins in adjoining Silver Bullion.	Ore milled yielded \$7.07 to \$24.40 in gold, a ton.	From 1927 to 1934 incl.; 1,166 oz. Au and 647 oz. Ag from 2,961 tons of ore.	Several adits, now inaccessible. Small cyanide plant operated inter- mittently for over 3 years.
48	Thomas (Edwards)	22	17N	20E	Replacement deposits in altered black shale at contact with syenite porphyry. Pyrite, and possibly tellurides in a zone 1 to 11 feet wide.	Some ore from winze reported to have averaged about \$18 gold a ton for 30-inch width.	1940-42; 26 oz. Au and 9 oz. Ag from 244 tons of ore.	Small cyanide plant operated for short time. Mine developed by 4 adits and a 30-foot winze. Water prevented further sinking of winze.
49	Voltaire (Hanson)	21	17N	20E	Replacement deposits in altered syenite porphyry and in contacting Benton shales. Auriferous pyrite in seams and cracks. Zone ranges from 1 to 6 feet in width.	Reported to average \$3 to \$6 a ton in gold.	None reported.	A 90-foot shaft and 350 feet of drifts and crosscuts. Small cyanide mill unsuccessfully operated. Gas in sedimentary rocks prevented sink- ing another shaft. Not worked since 1891. Workings now inaccessible.

MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/ (Continued)

Map ref. no.	Name of property or deposit 2/	Location Sec. T. R.	■ - Gold-Silver (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
50	Vulcan and Erie	35,36 18N 17E	Replacement deposits in limestone near syenite porphyry contact.	?	None	Extent of development work unknown. Workings now inaccessible.
51	Western Mines Corporation	11 16N 19E	Silver sulfides and tellurides associated with purple fluorite in silicified, brecciated bands in limestone.	Sorted ore 18 to 25 oz. Ag a ton.	1925-38 incl., 4 oz. Au and 1,936 oz. Ag from 94 tons of ore shipped.	Corporation organized to operate Silver Bell and other silver claims. Mill partly constructed before corporation was liquidated. Workings now accessible.
52	Whiskey Gulch	30 16N 20E	Replacement deposits in limestone along or near syenite porphyry contact. Similar to ore in deposits near Gilt Edge. No sulfides.	Reported to average about \$5.50 in gold a ton.	Unofficially reported to have been \$165,700 in gold during 1903 and 1904.	100-ton cyanide mill constructed in 1899 and mine operated extensively until 1904. Large deposits of both oxidized and black ore reported to remain below old workings. Workings now inaccessible.
53	White Elephant	17 16N 20E	Replacement deposits in limestone along or near syenite porphyry contact. Similar to Gilt Edge ore.	?	None	200-foot adit driven in 1904, now inaccessible. Now owned by Gilt Edge Mining Corporation.
54	Mocasek	16N 19E	Silver sulfides or tellurides in brecciated limestone.	?	None	Some high-grade ore mined from surface cut in early 1880's. No other information available.
▲ - Iron						
55	West Armells Creek	18,19 17N 20E	Limonite and some manganese oxides, precipitated from solution, occur along West Armells Creek for a distance of about 2 miles. In places deposit is 20 feet or more thick and ranges from 20 to 300 feet in width. Mixed with alluvial detrital material, tree branches, and pine needles.	Average iron content undetermined.	None	Some exposed areas appear to be a fair iron ore. One short adit, now caved, was driven on a manganese oxide band interbedded with the limonite.
56	Sutter (Hamilton-Sutter)	18 17N 20E	Iron gossan, approximately 100 feet across at its widest part, has been traced on the surface for about 1,300 feet. Gossan composed mainly of limonite. One small area contains scattered copper oxides and carbonates. In syenite porphyry.	To about 50% Fe.	113 tons of 6% copper ore shipped in 1916 and 1944.	Gossan in main adit 60 feet below surface divided into several zones. 2 to 30 feet wide. No sulfides in evidence. Shallow workings caved.
○ - Lead-Silver						
57	Pig Spring	15 17N 20E	Several small replacement deposits in limestone along or near syenite porphyry contact. Argentiferous galena, pyrite, and sphalerite.	Reported about 35% Pb, 18-20 oz. Ag and \$6 Au a ton.	No records available.	Numerous open cuts, several short adits, and a shallow shaft, now caved or inaccessible.
58	Blue Bell	26 18N 17E	Replacement deposit in thick-bedded limestone near syenite porphyry contact. Galena, sphalerite, pyrite, and chalcocypite.	?	16-ton shipment in 1916 contained 7 oz. Au, 193 oz. Ag, 788 lb. Cu, and 9,979 lb. Pb.	Extent of development unknown.
59	Cave	17,18 17N 20E	Replacement deposit in limestone. Argentiferous galena. Long narrow deposit averaged about 4 feet in width; length was about 300 feet. Except where exposed in a ravine, deposit did not outcrop.	?	Reported at 800 to 1,000 tons averaging about \$50 in Au, Ag, and Pb, a ton.	Ore hauled to smelter near Maiden in 1886 and 1887. Ore body reported to have been exhausted. One adit and upper workings now accessible; other workings caved.
60	Greshchuk (North or Accident)	22 17N 20E	Replacement deposits in limestone along or near syenite porphyry contact. Galena, sphalerite, pyrite, and chalcocypite.	?	In 1944; 5,400 lb. Pb from 47 tons of ore. Au, Ag, and Zn not reported.	600-foot adit drift and surface cuts. Workings now inaccessible.
61	Justice	6 16N 20E	Replacement deposits in limestone along or near syenite porphyry contact. Argentiferous galena with small amounts of other sulfides.	?	In 1909, 1 oz. Au, 251 oz. Ag, and 10,573 lb. Pb from 10 tons of ore.	One shallow shaft, 50-foot adit drift, 350-foot adit crosscut, and 158-foot raise. Last worked in 1909. Workings now inaccessible.

MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/ (Continued)

Map ref. no.	Name of property or deposit 2/	Location Sec. T. R.	⊙ - Lead-Silver (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
62	Matthews and Last Chance No. 2	5 16N 20E	Replacement deposits in and along a phenolite porphyry dike cutting syenite porphyry. Pyrite, galena, and sphalerite.	?	In 1940, 25 oz. Au, 78 oz. Ag, and 1,932 lb. Pb from 20 tons of ore.	80-foot shaft with 20-foot drift from shaft bottom, numerous open cuts. Last worked in 1940. Work- ings now inaccessible.
63	Old Nelson	5 16N 20E	Replacement deposit in a pipe or chimney in lime- stone near syenite porphyry contact. Argen- tiferous galena, sphalerite, and pyrite.	Reported about: 16% Pb, 12% Zn, 38 oz. Ag, and \$12 gold a ton.	In 1935, 1 oz. Au, 183 oz. Ag, and 1,250 lb. Pb from 5 tons of ore.	Claim is southeast from the Magimis mine. Extent of development un- known.
64	White and Gilpatrick (Last Chance)	17 17N 20E	Replacement deposits in limestone near syenite porphyry contact; galena, sphalerite, and pyrite. Also a narrow vein in syenite porphyry; sulfide minerals in quartz and calcite.	?	In 1936, 3 oz. Au and 160 oz. Ag from 5 tons of ore. Some early-day production, but no records available.	Numerous adits and open cuts, now caved or inaccessible. 60-foot adit, driven on narrow vein, in good condition.
⊙ - Lead-Zinc						
65	Armells Producer	22 17N 20E	A narrow replacement deposit in limestone near syenite porphyry contact. Galena, sphalerite, pyrite, and chalcocopyrite with their oxidation products.	-	3.47 tons shipped in 1937 assayed: 0.35 oz. Au, 4.2 oz. Ag a ton, 28.5% Pb, 0.10% Cu, 11.5% Zn, 2.0% S, 0.08% As, and 0.09% Sb.	2 shafts, one of unknown depth, one about 50 feet. Numerous open cuts and trenches. Both shafts now caved. Cuts and trenches closed by slough- ing.
66	Globe or Black Bull	7 16N 20E	Replacement deposits along contact of limestone and syenite porphyry, and as a pipe or chimney in the limestone near contact; galena, sphalerite, pyrite, and chalcocopyrite with their oxidation products. Also a narrow vein in syenite porphyry with copper minerals.	Sorted ore assay- ed: 0.07 oz. Au, 3.9 oz. Ag, 32.4% Pb, 2.14% Cu, and 29.4% Zn.	1936-42, incl.; 28 oz. Au, 825 oz. Ag, and 5,016 lb. Cu from 69 tons of ore. About 100 tons lead ore shipped in 1948. No records of early-day production available.	Second lode mining claim located in Fergus County. Worked intermit- tently until about 1905. Several shafts, open cuts, and adits. One shaft open for about 50 feet but now in- accessible. One long adit in good condition; others caved.
67	Great Falls and Judith Basin Mining Co.	7,18 16N 20E	Replacement deposits in limestone along or near syenite porphyry contact. Galena, sphalerite, pyrite, and chalcocopyrite with their oxidation products. Deposits narrow, ranging from 0.5 to 1.0 foot in width.	Trace to 0.025 oz. Au, Au, 25 to 30.10 oz. Ag, 4.6 to 31.7% Zn, and 1.5 to 30.2% Pb.	None assayed: 0.35 oz. Au, 4.2 oz. Ag a ton, 28.5% Pb, 0.10% Cu, 11.5% Zn, 2.0% S, 0.08% As, and 0.09% Sb.	700-foot and 300-foot adits in syenite porphyry below contact. Several short adits and numerous open cuts. Workings now inaccessi- ble.
68	High Hope (Golden Armells Mining Co.)	15 17N 20E	Replacement deposits along contact of limestone and syenite porphyry dike; also replacements in syenite porphyry near the contact. Deposits 8 inches to 2 feet in width; contain galena, sphalerite, and pyrite with their oxidation products.	?	None assayed: 0.35 oz. Au, 4.2 oz. Ag a ton, 28.5% Pb, 0.10% Cu, 11.5% Zn, 2.0% S, 0.08% As, and 0.09% Sb.	15-foot shaft on contact and 20-foot adit in porphyry, both accessible.
69	Iron Chancellor	18 16N 20E	Replacement deposit along limestone-syenite porphyry contact; also vein in limestone near the contact. Ore is complex mixture of galena, sphalerite, pyrite, and chalcocopyrite with their oxidation products. Contact deposit 3 to 4 feet wide. Vein ranges from a few inches to 3 feet in width.	Averages about: 0.02 oz. Au, 2.6 oz. Ag, 17.6 to 34.0% Pb, 0.32 to 2.10% Cu, and 25.5 to 31.2% Zn.	Small production, but no records available.	Approximately 400 feet of develop- ment includes 180-foot adit, 80 feet of drifts, 90-foot shaft, and 20- foot winze. Several shallow pits and open cuts. Long adit repaired during 1948. Shaft and upper work- ings inaccessible.
70	Lead Chief (Parrent)	1 16N 17E	Lense-shaped replacement deposit in limestone near syenite porphyry contact. Complex mixture of galena, sphalerite, pyrite, chalcocopyrite, and their oxidation products. Deposit about 25 feet long; ranges in width from 4 to 6 inches at the ends to about 4 feet at the center.	Selected B.L. sample assayed: 0.01 oz. Au, 6.17 oz. Ag, 7.3% Pb and 24.0% Zn.	None reported.	3 adits and 1 inclined shaft. 2 adits in limestone and shaft now inaccessible. 1 adit, driven 103 feet in syenite porphyry in good condition.
71	Montclair (Landheim)	17 17N 21E	Replacement deposit along a limestone-syenite porphyry contact; also narrow vein in limestone near the contact. Reported to contain galena and sphalerite.	?	None	Open cut made by bulldozer. No sulfide minerals in evidence.

MINERAL INDUSTRY SURVEY TABLE
FERGUS COUNTY, MONT. 1948
Metallic Mineral Deposits 1/ (Continued)

Map ref. no.	Name of property or deposit 2/	Location			- Lead-Zinc (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
		Sec.	T.	R.				
72	Parsons	25	18N	17E	Replacement deposit at contact of limestone and syenite porphyry. A narrow vein containing galena, sphalerite, and pyrite with quartz and calcite extends into the limestone. A 6-foot fault vein contains coarse crystals of galena, sphalerite, and clear crystals reported to be topaz.	?	None reported.	Open cut, several adits, an 80-foot drift with 20-foot winze on fault vein. Two adits in good condition. Drift and winze now inaccessible.
73	Republic (Hamilton Lead)	23	16N	17E	Brecciated altered porphyry pipe about 100 feet across, in thin-bedded shales. Contains scattered galena, sphalerite, pyrite, and chalcopryrite. Principal mineralization in lense, 2 feet in maximum width along northern edge of pipe.	Selected B.M. samples assayed: 0.01 oz. Au, 3.9 to 5.7 oz. Ag, 10.0 to 21.0% Pb, 37.5 to 40.2% Zn, and 0.20 to 0.27% Cu.	Two cars of ore reported shipped prior to 1907. No records available.	100-foot and 45-foot shafts about 40 feet apart connected on 40-foot level by a crosscut. Short crosscut on 100-foot level. Workings now inaccessible.
74	War Eagle	7	16N	20E	Replacement deposits in limestone along or near syenite porphyry contact. Also in brecciated zone in the porphyry. Galena, sphalerite, pyrite, chalcopryrite, and their oxidation products. Ore bodies irregular. One chimney along the contact reported to have contained up to 80 oz. Ag a ton.	Brecciated zone: trace Au, 0.54 oz. Ag, 3.0% Pb, and 6.1% Zn.	No records available prior to 1910. 1910-13 incl.: 4 oz. Au, 510 oz. Ag, 2,348 lb. Cu, 74,464 lb. Pb, and 159,295 lb. Zn from 340 tons of ore.	First lode claim located in Warm Spring district. Some ore smelted at small lead smelter near Maiden. 3 adits, 80-foot inclined shaft, and 70-foot winze. Shaft now caved, but adits and some of upper workings open. Winze inaccessible because of water.

1/ Classified according to principal or predominating metal.
2/ Also known by names in parenthesis.

BIBLIOGRAPHY

1. Blixt, John E., *Geology and Gold Deposits of the North Moccasin Mountains, Fergus County, Mont.*: Montana Bureau of Mines and Geology, Mem. 8, 1933, 25 pp., 4 pls. (incl. map), 1 fig.
2. Byrne, John, and Hunter, Frank, *Twelfth Ann. Rept. of the Inspector of Mines of the State of Montana*: Independent Pub. Co., Helena, Mont., 1901, 86 pp.
3. Byrne, John, and Hunter, Frank, *Fourteenth Ann. Rept. of the Inspector of Mines of the State of Montana*: Independent Pub. Co., Helena, Mont., 1902, 96 pp.
4. Calvert, William R., *Geology of the Lewistown Coal Field, Mont.*: U. S. Geol. Survey Bull. 390, 1909, 81 pp., map.
5. Corry, A. V., *Some Gold Deposits of Broadwater, Beaverhead, Phillips, and Fergus Counties, Mont.*: Montana Bureau of Mines and Geology, Mem. 10, 1933, 45 pp., 9 pls., 12 figs.
6. Ferguson, J. A., and Benedict, L. P., *Montana Bureau of Labor, Agriculture, and Industry, 8th Bienn. Rept.*, 1902, 733 pp.
7. Freeman, Otis W., *The North Moccasin Mountains of Montana*: Min. and Eng. World, vol. 42, 1915, pp. 947-949, map.
8. Freeman, Otis W., *Gold Mining in the Judith Mountains, Montana*: Min. and Sci. Press, vol. 112, 1916, pp. 863-865, 1 pl.
9. Freeman, Otis W., *Gypsum and Lime Industry in Central Montana*: Min. and Eng. World, vol. 45, 1916, pp. 663-665.
10. Freeman, Otis W., *Mineral Prospects in Fergus County*: Eng. and Min. Jour., vol. 103, 1917, pp. 660-662.
11. Gerry, C. N., *Gold, Silver, Copper, Lead, and Zinc in Montana in 1911 (Mine Report)*: U. S. Geol. Survey, Mineral Resources, 1911, pt. 1.
12. Gerry, C. N., *Gold, Silver, Copper, Lead, and Zinc in Montana in 1915 (Mine Report)*: U. S. Geol. Survey, Mineral Resources, 1915, pt. 1.
13. Gerry, C. N., *Gold, Silver, Copper, Lead, and Zinc in Montana in 1916 (Mine Report)*: U. S. Geol. Survey, Mineral Resources, 1916, pt. 1.
14. Gerry, C. N., *Gold, Silver, Copper, Lead, and Zinc in Montana in 1917 (Mine Report)*: U. S. Geol. Survey, Mineral Resources, 1917, pt. 1.
15. Gerry, C. N., *Gold, Silver, Copper, Lead, and Zinc in Montana in 1919 (Mine Report)*: U. S. Geol. Survey, Mineral Resources, 1919, pt. 1.

BIBLIOGRAPHY (Cont'd.)

16. Gerry, C. N., Gold, Silver, Copper, Lead, and Zinc in Montana in 1920 (Mine Report): U. S. Geol. Survey, Mineral Resources, 1920, pt. 1.
17. Gerry, C. N., Gold, Silver, Copper, Lead, and Zinc in Montana in 1921 (Mine Report): U. S. Geol. Survey, Mineral Resources, 1921, pt. 1.
18. Gerry, C. N., Gold, Silver, Copper, Lead, and Zinc in Montana in 1923 (Mine Report): U. S. Geol. Survey, Mineral Resources, 1923, pt. 1.
19. Gerry, C. N., Gold, Silver, Copper, Lead, and Zinc in Montana in 1924 (Mine Report): U. S. Bureau of Mines, Mineral Resources, 1924, pt. 1.
20. Gerry, C. N., Gold, Silver, Copper, Lead, and Zinc in Montana in 1928 (Mine Report): U. S. Bureau of Mines, Mineral Resources, 1928, pt. 1.
21. Gerry, C. N., and Miller, T. H., Gold, Silver, Copper, Lead and Zinc in Montana in 1929 (Mine Report): U. S. Bureau of Mines, Mineral Resources, 1929, pt. 1.
22. Miller, T. H., Gold, Silver, Copper, Lead and Zinc in Montana in 1930 (Mine Report): U. S. Bureau of Mines, Mineral Resources, 1930, pt. 1.
23. Hogan, Joseph, and Oliver, Jacob, Third Annual Rept. of the Inspector of Mines of Montana for the Fiscal Year 1891; Journal Pub. Co., Helena, Mont., 1891, 75 pp.
24. Hogan, Joseph, and Oliver, Jacob, Fourth Annual Rept. of the Inspector of Mines of the State of Montana: C. K. Wells Co., Printers & Binders, Helena, Mont., 1892, 71 pp.
25. Hoyt, B. F., The Judith Mountains, Fergus County, Mont.: Min. and Eng. World, vol. 41, no. 21, 1914, pp. 957-958.
26. Hoyt, B. F., Gold Hill Section of Maiden District, Mont.: Min. and Eng. World, vol. 42, no. 4, 1915, pp. 171-172.
27. Leeson, M. A., History of Montana 1739-1885: Warner, Beers & Co., Chicago, Ill., 1885, 1367 pp.
28. Needham, C. E., Economics and Statistics Division, U. S. Bureau of Mines, Salt Lake City, Utah.
29. Roby, R. N., and Robertson, Almon F., Investigation of Whiteware Clay Deposit, Fergus County, Mont.: U. S. Bureau of Mines, Rept. of Investigations 4416, 1949, 11 pp., map.
30. Trauerman, Carl J., and Waldron, Cecil R., Directory of Montana Mining Properties: Montana Bureau of Mines and Geology, Mem. 20, 1940, 135 pp., 29 pls.

BIBLIOGRAPHY. (Cont'd.)

31. Walsh, William, and Oren, William, Bienn. Rept. of Inspectors of Mines of the State of Montana for 1905-1906, 1906, 166 pp.
32. Walsh, William, and Oren, William, Bienn. Rept. of Inspectors of Mines of the State of Montana for 1909-1910, 1910, 130 pp.
33. Waldron, Cecil R., and Oren, William, Bienn. Rept. of Inspectors of Mines of the State of Montana for 1911-1912, 128 pp.
34. Weed, W. H., and Pirsson, L. V., Geology and Mineral Resources of the Judith Mountains of Montana: Geol. Survey, 18th Ann. Rept., pt. 3, 1898, pp. 437-616, 18 pls., 25 figs.
35. Mining and Scientific Press, Judith Basin, Montana: Vol. 101, no. 13, 1910, pp. 398-400, 2 pls.
36. Mining World, Mining in Fergus County, Mont.: Vol. 20, no. 22, 1904, pp. 23-36, 13 pls.
37. Engineering and Mining Journal, The Mines of Judith Basin, Montana: vol. 78, no. 3, 1904, p. 96, 2 pls.